CQ

W2FX

AUGUST, 1946

The Radio Amateurs' Journal

25¢

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TRIODE

ELECTRICAL CHARACTERISTICS

Filament: Thoriated tungsten	
Voltage	5.0 volts
Current	4.0 amperes
Amplification Factor (Average)	39
Direct Interelectrode Capacitances (Average)	
Grid-Plate	1.8 uuf
Grid-Filament	2.5 uuf
Plate-Filament	0.4 uuf
Transconductance (i_b = 100 ma., E_b = 2000 V., E_c = −30 V.)	2850 umhos
Frequency for Maximum Ratings	100 mc

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Vol. 2 No. 8 **AUGUST, 1946**

COVER

Members of the Washington Radio Club who journeyed to the Shenandoah National Park for field day, photographed with their installation at the Pinnacles, about 3,450 feet above sea level in the Blue Ridge mountains. Visible in the foreground is G2JK, a visitor, and W4GPW's XYL who is Secretary of the WRC. The rig is a 25 watt 10 meter phone transmitter operating from a 300 watt gasoline operated generator which also handled all receivers and additional transmitters. (*Photo by Jack Wilson, ex-W3AMY*).

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The Cardwell Fifty-Four

the first really new communications receiver in years

The crowd was so dense around the Cardwell Fifty-Four at the Radio Parts Show in Chicago that we thought it would be only fair to give you another look at it. Here it is. Compare these 16 features:

1. Full Turret Type R. F. Section.
(Sturdy cast aluminum construction.)

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(Range .54 to 54.0 mcs. Basic turret covers .54 through 40 mcs. in six bands. Extra coil strip supplied with set extends range to 54 mcs.)

3. Secondary Frequency Standard.
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4. Variable Selectivity Crystal Filter.
(Choice of 5 degrees of selectivity—three with crystal, two without.)

5. Exceptional Signal to Noise Ratio.
(Receiver noise less than 6 db above thermal!)

6. New Type Noise Limiter.
(A really effective aid in reducing local ignition interference and similar noises.)

7. Electrical Band Spread.
(Band spread scales calibrated directly. Arbitrary scale 0-100 also visible on each setting.)

8. Direct Reading Precision Dials.
(Excellent visibility—pointer travel better than 10½ inches—velvet smooth dial action.)

9. Temperature Compensated Oscillator.
(Stability is better than 25 parts per million per degree centigrade. V.R. tube maintains maximum frequency stability against line voltage fluctuations.)

10. Mechanical Coupling Provisions.
(Control shafts are brought out at rear for linkage to other units such as a transmitter exciter.)

11. All Aluminum Unit Construction.
(Receiver and power supply combined in one sturdy lightweight unit 18¼" wide x 16" deep x 11" high. Weight approximately 70 lbs.)

12. Heavy Duty Speaker.
(Compact tilting unit 9¼" wide x 8¼" deep x 11" high for wall or table mounting.)

13. Eight Watts Audio Output.
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14. 18 Tubes—All Miniature.

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16. Panoramic Adaptor Jack.

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. . . Zero Bias . . .

Shared Frequencies!

Parts of 20 and 40 have just been reopened. It's a great feeling to be back on the reliable DX bands—even if we don't have all of them yet. We can expect the remainder of our frequencies this year. Then all the ham bands will be ours except, unfortunately, 160 meters.

But to anyone who has operated on 20 or 40 before the war these bands sound differently today. They are! We seem to be sharing them with a multitude of commercial services, both c.w. and phone, broadcast and point-to-point. Until all non-amateur services move out of the ham bands, serious interference will result from these trespassers.

FCC control is limited to the United States and its possessions. Foreign interference requires handling through relatively slow international channels. Complete clearance of all unauthorized stations from our frequencies is a project that must be inaugurated immediately, even while waiting for our remaining frequencies. Log all signals heard inside our bands that sound as if they do not belong there. Record date, time, type of service and frequency. Mail this data to us and we will see that the proper authorities receive it promptly. Complaints to the FCC must be substantiated with facts and figures!

Another important consideration in the reopening of the amateur bands is the phone activity in c-w portions of the band. Foreign governments, which have sub-divided their bands in an entirely different manner, have authorized voice operation within the c-w portion of most U. S. bands. While it is undeniably true that if DX phones worked within the U. S. phone allocations they would probably be permanently "smeared," it is not fair that they occupy large portions of the workable c-w spectrum. International agreement on sub-division of phone and c-w is certainly necessary.

The solution to this problem is likely to be very difficult because there is a wide difference of opinion. On existing frequencies it seems almost impossible to make further sub-divisions. Additional frequencies just outside of U. S. allocations have worked well for DX c-w stations, although these frequencies are unauthorized in many of the countries where the practice is widespread. DX phone concentrated just outside the U. S. phone band may work, although on the c-w side it would mean de facto recognition of additional phone frequencies, something that will come only after extensive negotiations. Illegal operation of any sort, especially off-frequency operation, cannot be condoned by responsible amateurs, so the solution to the problem must conform to regulations. With the phone band being moved to one end of 20 the problem is not without an apparent solution on 14 mc, but on 40 and 80, where South American and Central American phones are a serious interference problem, there is certainly no assurance that they will move to that portion of the band allocated for U. S. phone operations.

This complex problem calls for mature debate by all interested amateurs. It is a problem CQ intends to keep very much alive until a satisfactory solution has been reached. We would welcome getting your ideas on the subject.

DX Techniques

In previous editorials we have discussed the problem of the v.f.o. Now that frequencies on all DX bands have been reopened, another operating practice warrants discussion. Entirely too many operators are calling DX stations indiscriminately before the DX station has finished the QSO or before the DX station operator indicates he is tuning for a new QSO. A recent example of this was the experience of VS4JH. A W2 was working him, and upon completing the QSO, requested VS4JH to listen for two locals approximately ten kc higher in frequency. What happened was disgraceful. Almost the entire low end of the band called VS4JH, with the result that he found it impossible to QSO the W2's. Many similar cases where DX stations have been listening for hometown contacts and prearranged schedules could be cited. On one DX schedule we know of, the DX station operator omitted signing his call to avoid interference. Good sportsmanship is essential with the bands so crowded. Don't be a poor amateur, and don't be afraid to gently remind offenders of good operating practice.

Portable Mobile Operation

In June CQ we discussed the problems facing an amateur working portable mobile. We have received many letters from amateurs and police officials. The suggestions have been most constructive and we will have a complete report as soon as correspondence between interested parties is completed.

Save Weight!
Save Space!

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- **WORKING PORTABLE**
- **WORKING MOBILE**

New T-3 tube ideal for high frequency operation

You remember the tiny tube that became the heart of the famous proximity fuze—the complete radio transceiver capable of being fired from a gun!

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In addition to the plated feature type AX2 embodies a long list of other Bliley accomplishments that have made the name Bliley a by-word for top performance throughout the amateur radio field.

Nothing has been overlooked or omitted in type AX2 to give your equipment the ultimate in frequency control under all conditions. Type AX2 and other Bliley amateur crystals are fully described in Bulletin 31, available at your authorized Bliley distributor.

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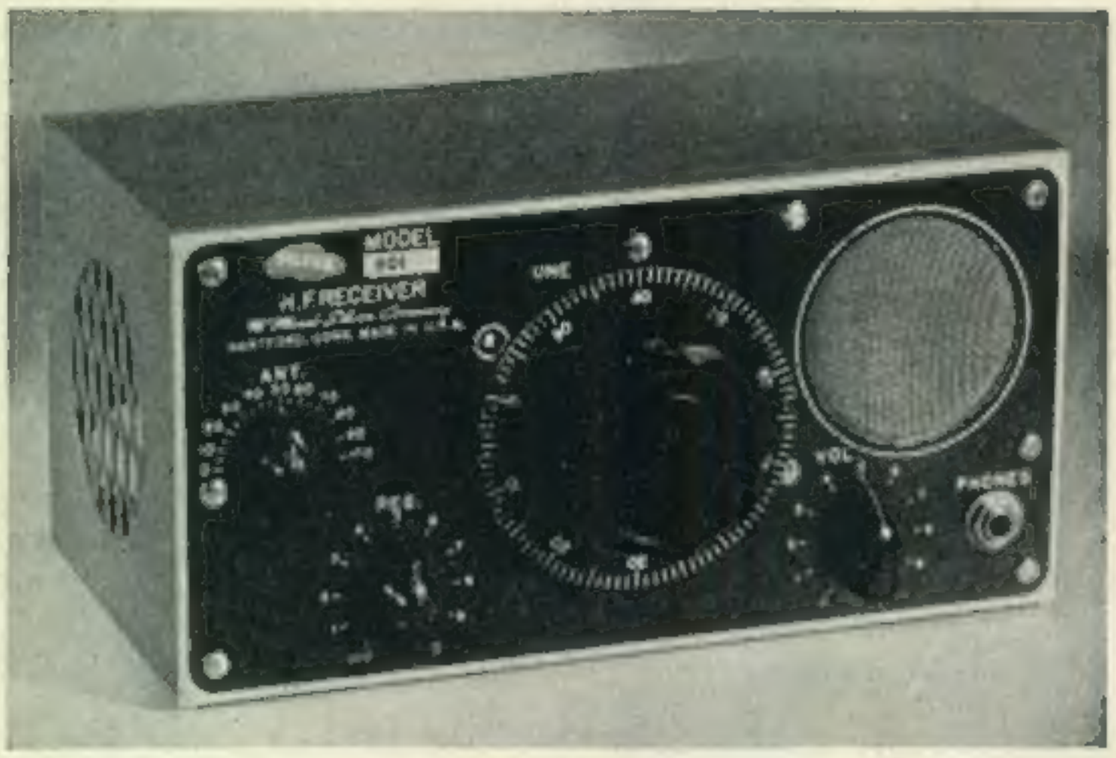
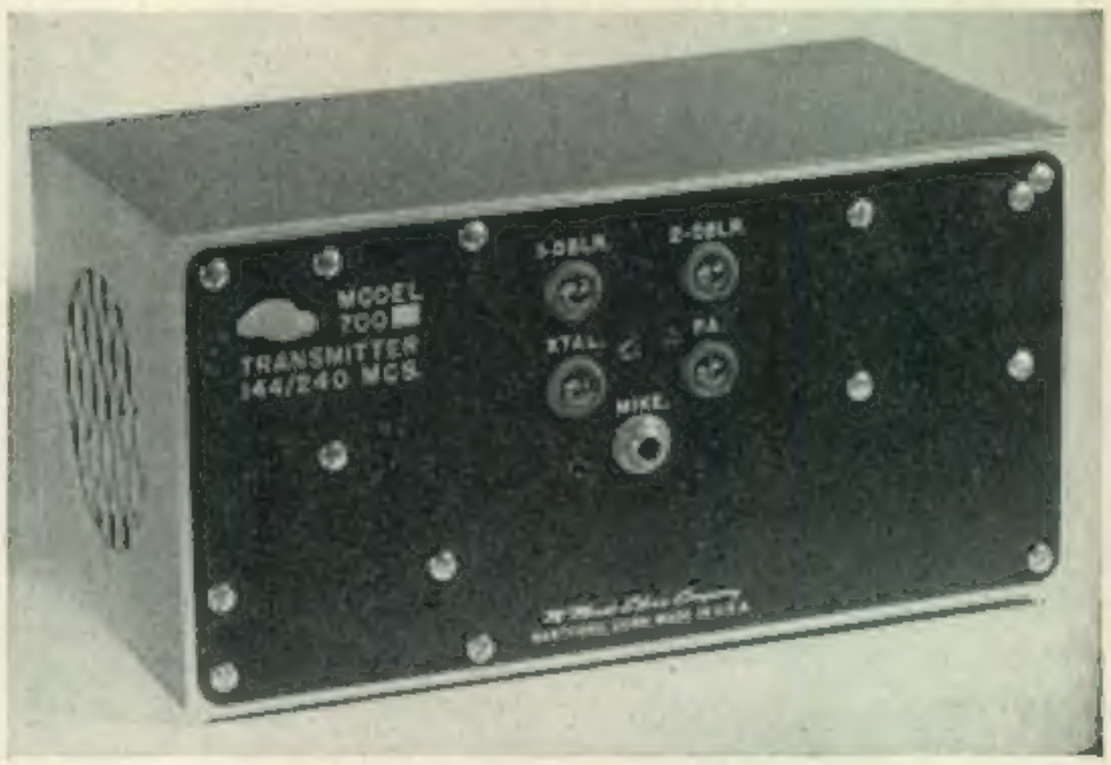


MODEL 800 144-148 and 235-240 mcs. U.H.F. receiver. Edward P. Tilton's Feb. 1946 QST design modified to Byron Goodman's *inductive* r.f. tuning, built-in PM speaker, 88" band-spread, all in new "ATOM-X" construction. Factory built or kit for easy home construction, compact.

MODEL 700 xtal controlled transmitter. 144-148 and 235-240 mcs. 6AQ5 Tritet drives 6C4 doubler, 6C4 doubler/tripler, 832 longline push-pull final. Built-in 14 watt 6AQ5 push-pull voice modulator. New "ATOM-X" construction, size only 5" x 10" x 5¼". Matches MODEL 800. Makes serious home-station or mobile rig. Factory built or kit.



Illustrated and high spotted above are but two of many fresh, *post-war* receivers, transmitters, factory built or kits and parts designed by and for serious amateurs. Prices are as low as quality is high. A penny post-card will bring you catalog of what's new . . . your favorite jobber will have them soon.

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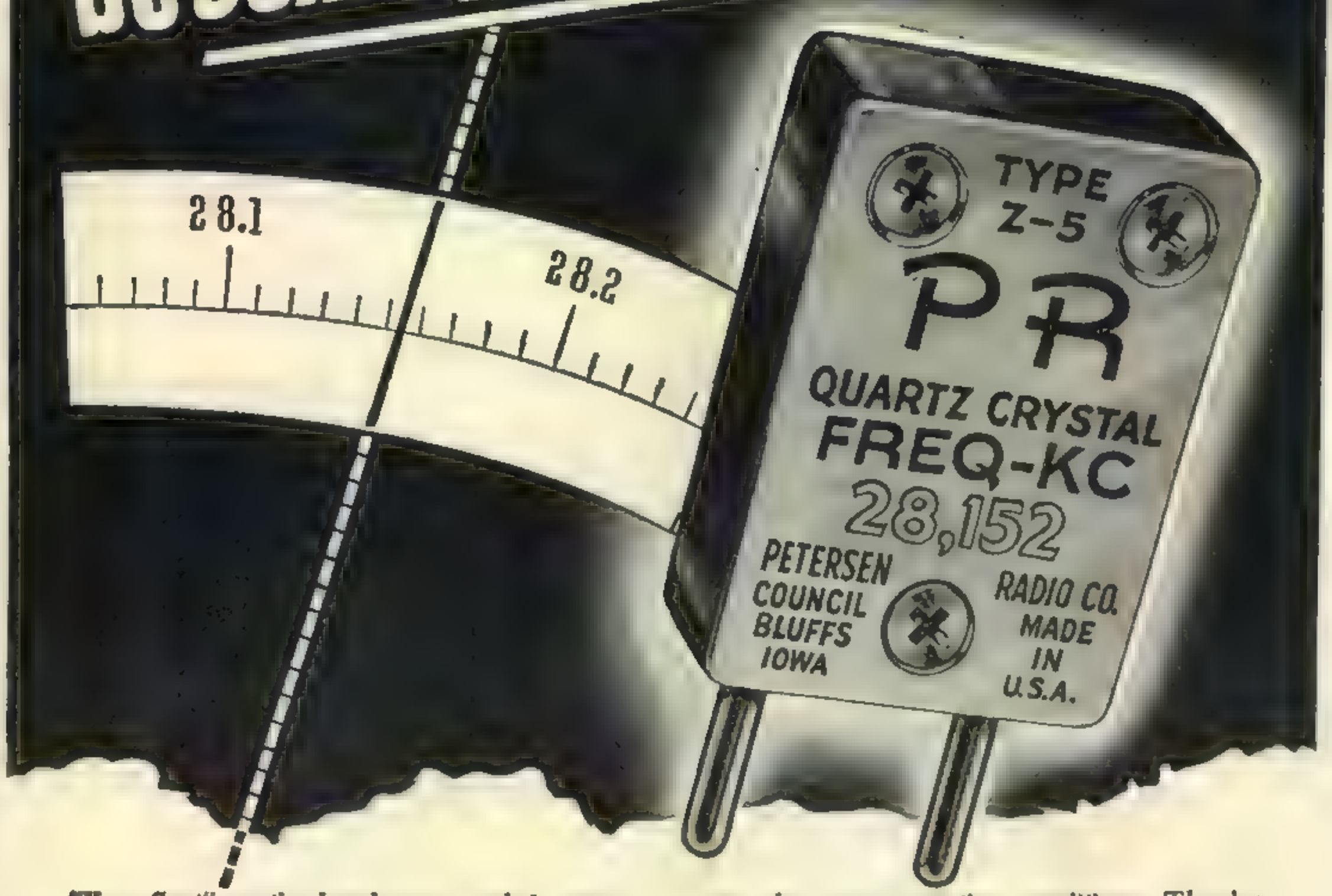

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40 & 80 METERS PR Type Z-2.	Rugged. Low Drift (less than 2 cycles per MC per degree centigrade). High keying activity. High power output. Accurate calibration $2.65

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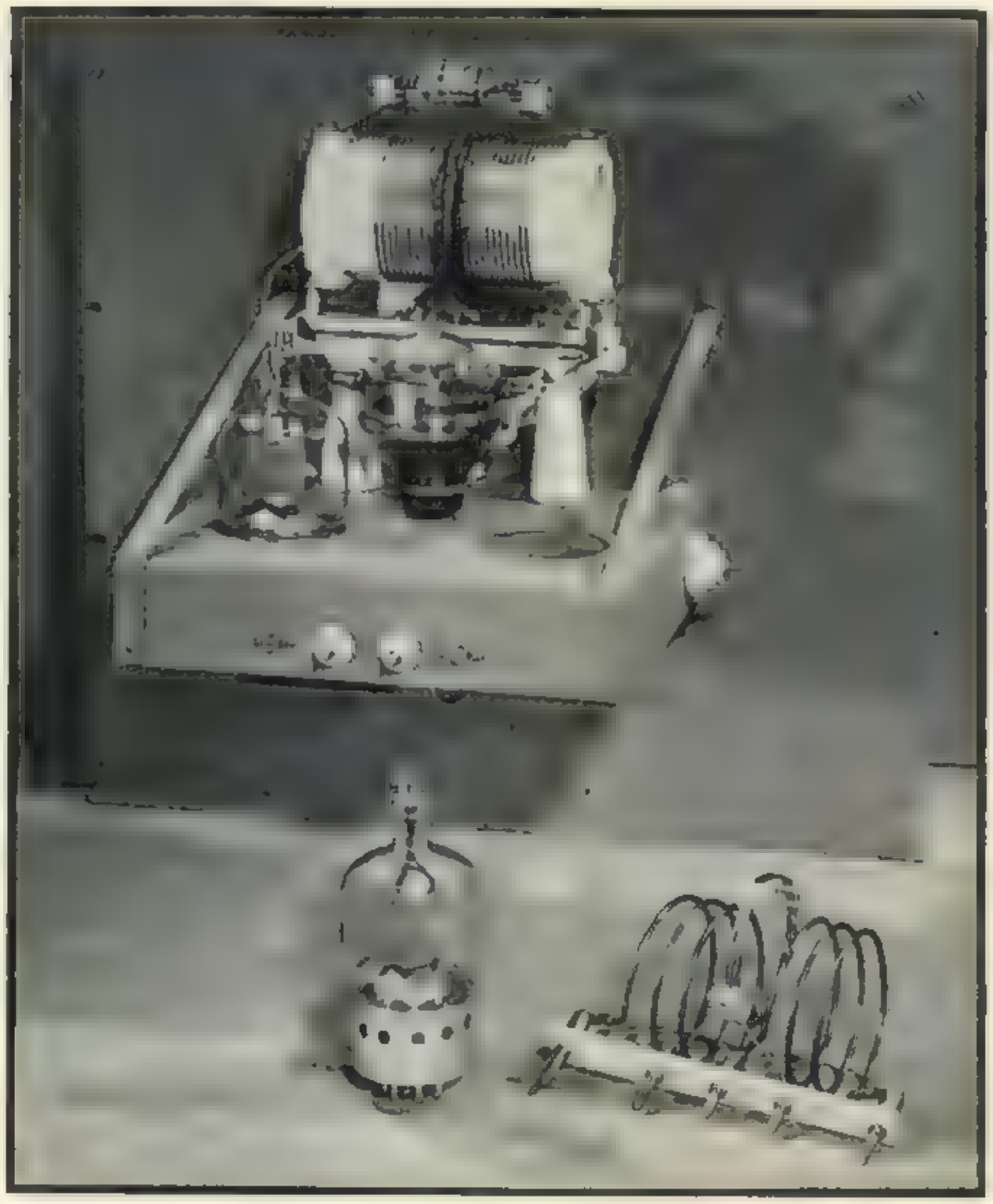


Rear view of PA, showing method of mounting chassis on panel and the position of tubes, coil and vacuum condensers. Long r-f leads are conspicuously absent. The 80-meter coil is plugged in, the 10-meter coil is lying in front. For grid tuning, the two small variables, one each side of the link feed-through insulators, need be adjusted but once

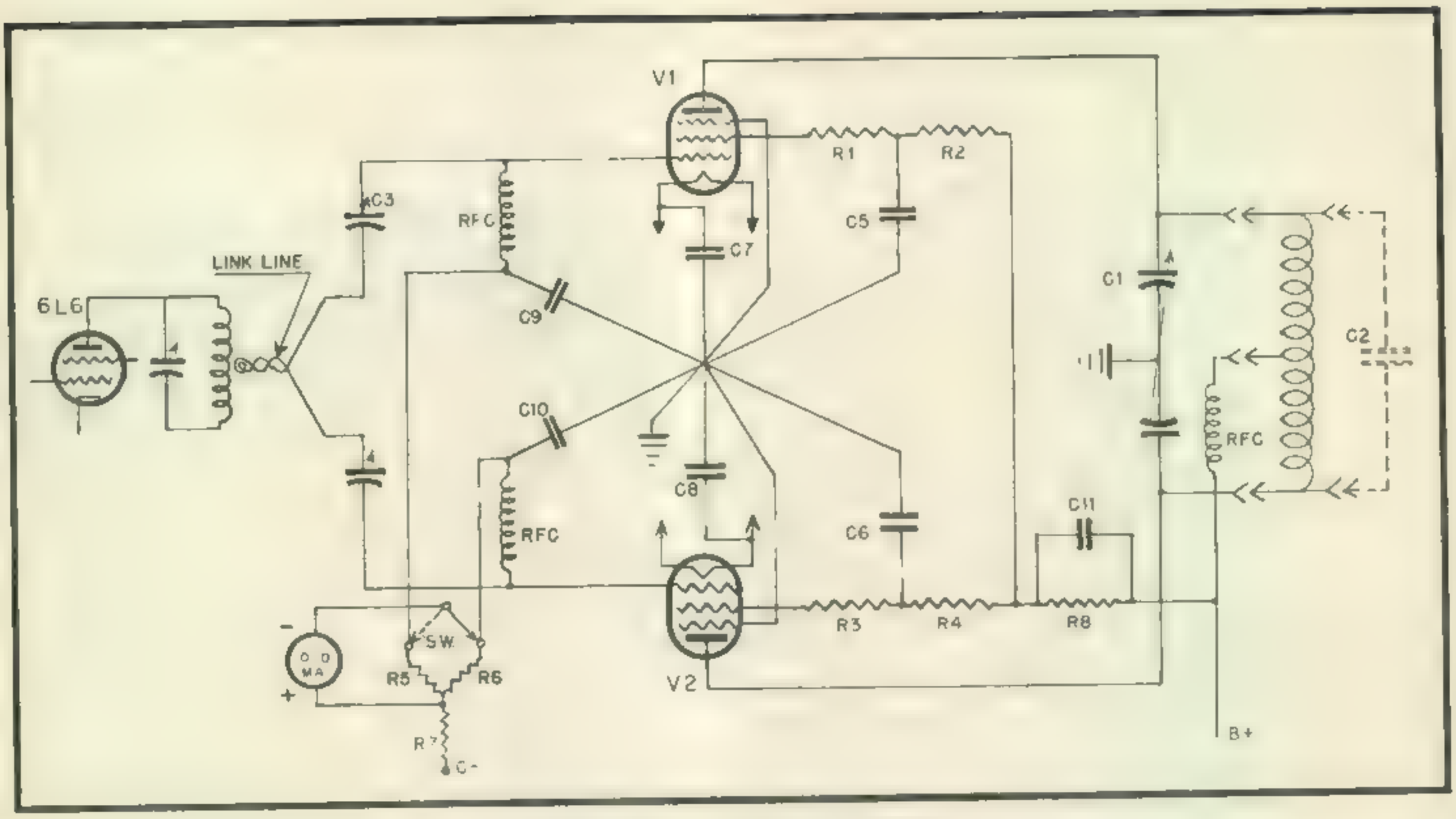
JOHN E. STRIKER
W6MOV-OPG*

New ideas in final amplifiers are almost as rare as those in new cars. But this unit uses something new in amateur radio, a vacuum variable condenser. Low cost, easy drive, and a single dial control are other features that make this PA of special interest to hams

The use of "easy-to-drive" tubes started several years ago, but cost largely limited their application to other than output stages. In addition to being expensive, the physical construction of many high-gain tubes made them temperamental. Some still had to be neutralized, parasitics developed, and even a momentary overload resulted in another pair of tubes landing in the garbage can. But the new tetrode series has changed the picture. It was decided to use a pair of APE-257-C's due to their efficiency at high frequencies and the extremely high output obtained with low drive. (A fraction of one watt will drive them easily to 1 kw input). We should not lose sight of the fact that triodes cost considerably more to drive than tetrodes, and amateurs are interested in getting the most watts per dollar!

The driving requirements are so low, the r-f exciter can stay well within the "flea-power" class. No grid-tuned circuit or neutralizing condensers are necessary, which reduces the overall construction costs even further. The use of the new split-stator vacuum variable condenser in this amplifier permits very compact construction, and since by this means overall length of circuit elements is appreciably reduced, the efficiency at high frequencies is excellent. However, a conventional split-stator condenser of sufficient plate spacing may be substituted with good per-

*1655 Everett Ave., San Jose 10, Calif.



Circuit diagram of power amplifier

C1—4-40 $\mu\mu$f per section vacuum variable (Jennings Radio)
C2—Vacuum fixed capacitor
C3, C4—50 $\mu\mu$f midget (Hammarlund APC-50)
C5, C6—.002 mica
C7, C8, C9, C10—.001 mica
C11—.01 mica
R1, R2, R3, R4—40 ohm, 1 watt, non-inductive
R5, R6—50 ohm, 1 watt
R7—100,000 ohm, 1 watt
R8—50,000 ohm, 100 watt
SW—SPDT toggle
T1—5 v. 15 amp. (Thordson T-19F85)
V1, V2—Pacific Electronics APE-257-C

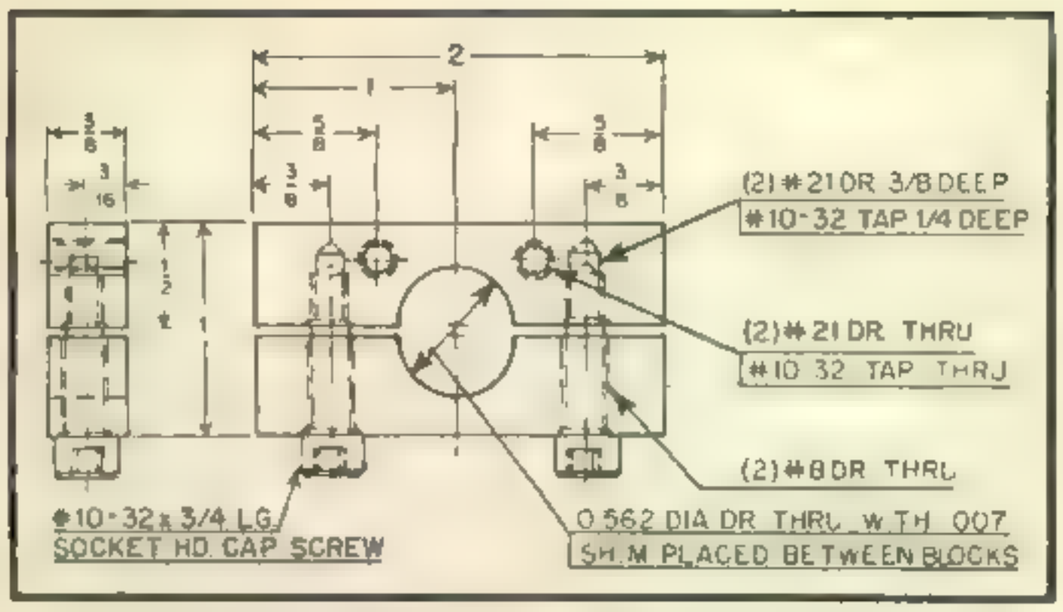
formance. This, of course, necessitates a larger chassis, and some re-arrangement of parts to accommodate the particular condenser used. It could be mounted in the area where the vacuum condenser and coil supports are located with the tank coil mounted on top of the condenser in the conventional manner. It would be necessary, however, to use a chassis slightly wider for proper mounting. A flexible coupling may still be used to rotate the condenser.

Low-frequency Padding

The usual padding for the lower frequencies is done with a fixed vacuum condenser across the lower frequency coils. The elimination of a tuned grid circuit also considerably reduces the parasitic bug-a-boo. In fact, with merely the usual precautions being taken in the way of low value, non-inductive resistors in both the screen and control-grid circuits, it was impossible to note any oscillation or instability on any of the amateur bands. The r-f voltage across the series grid parasitic resistors which were originally used caused them to become over-heated, and they were consequently removed. No difference in the operating conditions whatsoever could be detected without them. Perhaps those in the screen circuit (*R-1, 2, 3, 4*) could also be eliminated; however, these ran perfectly cold and were left in. A .01 μf condenser (*C-11*) is placed across the screen-grid dropping resistor (*R-8*) to provide a low impedance path for the a.f., thereby properly modulating the screen. This eliminates the necessity of using a special modulation transformer when screen grid tubes are plate and screen modulated.

The only tuning adjustment on the amplifier is the plate tank tuning condenser. In lieu of flexible couplings to drive this condenser, they

Front view of the amplifier showing the visual indicator and control knob. Simplicity in appearance and operation is featured



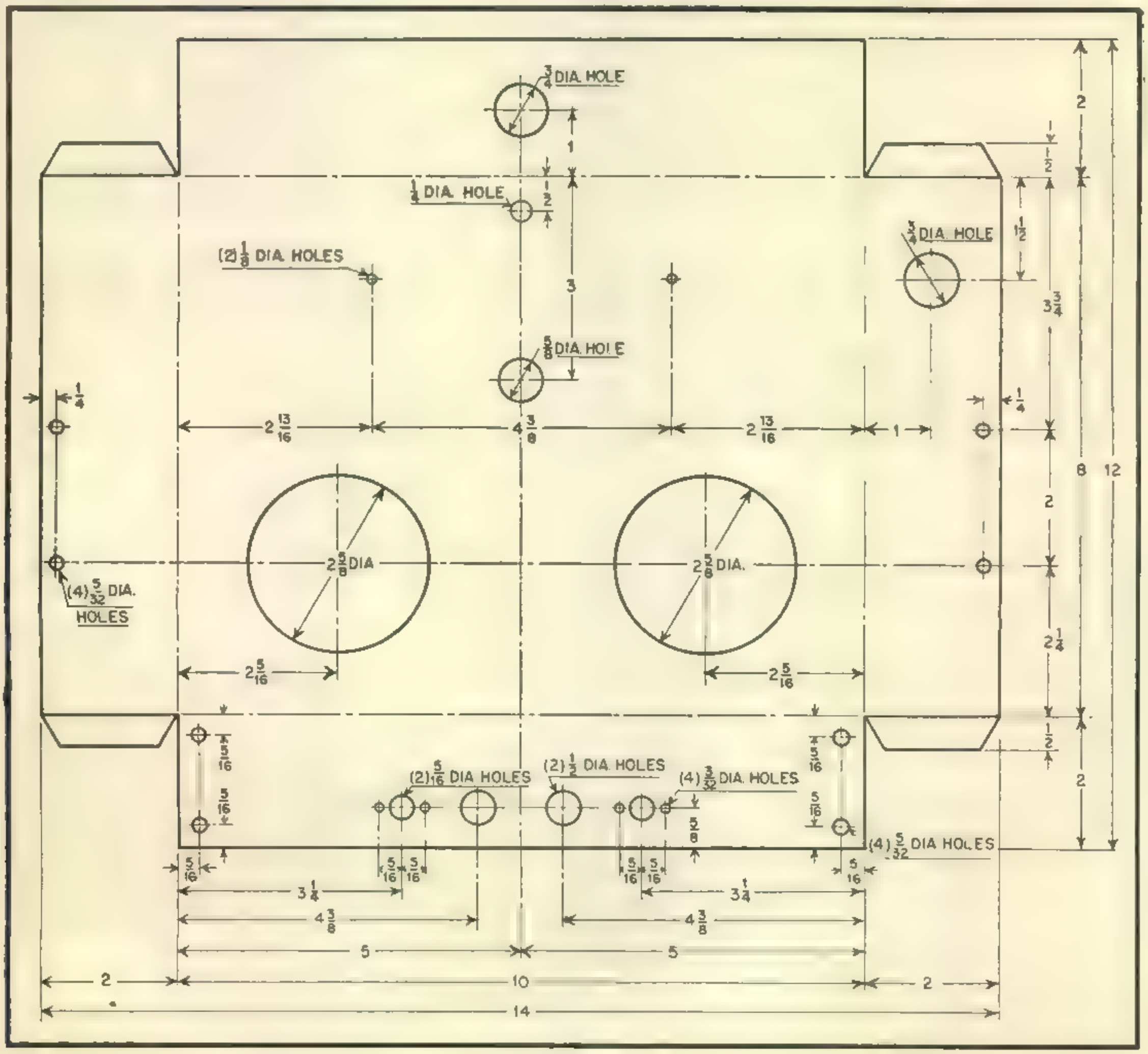
Vacuum condenser mounting block details

may be easily made by using two small pieces of one-fourth inch tubing and a short length of speedometer cable. As the condenser rotor is at ground potential, no insulation problems exist. However, it should be mounted with a metal block below the chassis. The two variable coupling condensers (*C-3, C-4*) are adjusted once and then forgotten, as the proper amount of excitation for each band will be taken care of by the number of turns in the link coupling coil on the exciter output stage. A single-pole, double-throw switch (*SW-1*) is employed to cut in a meter to measure the amount of grid current flowing in each tube.

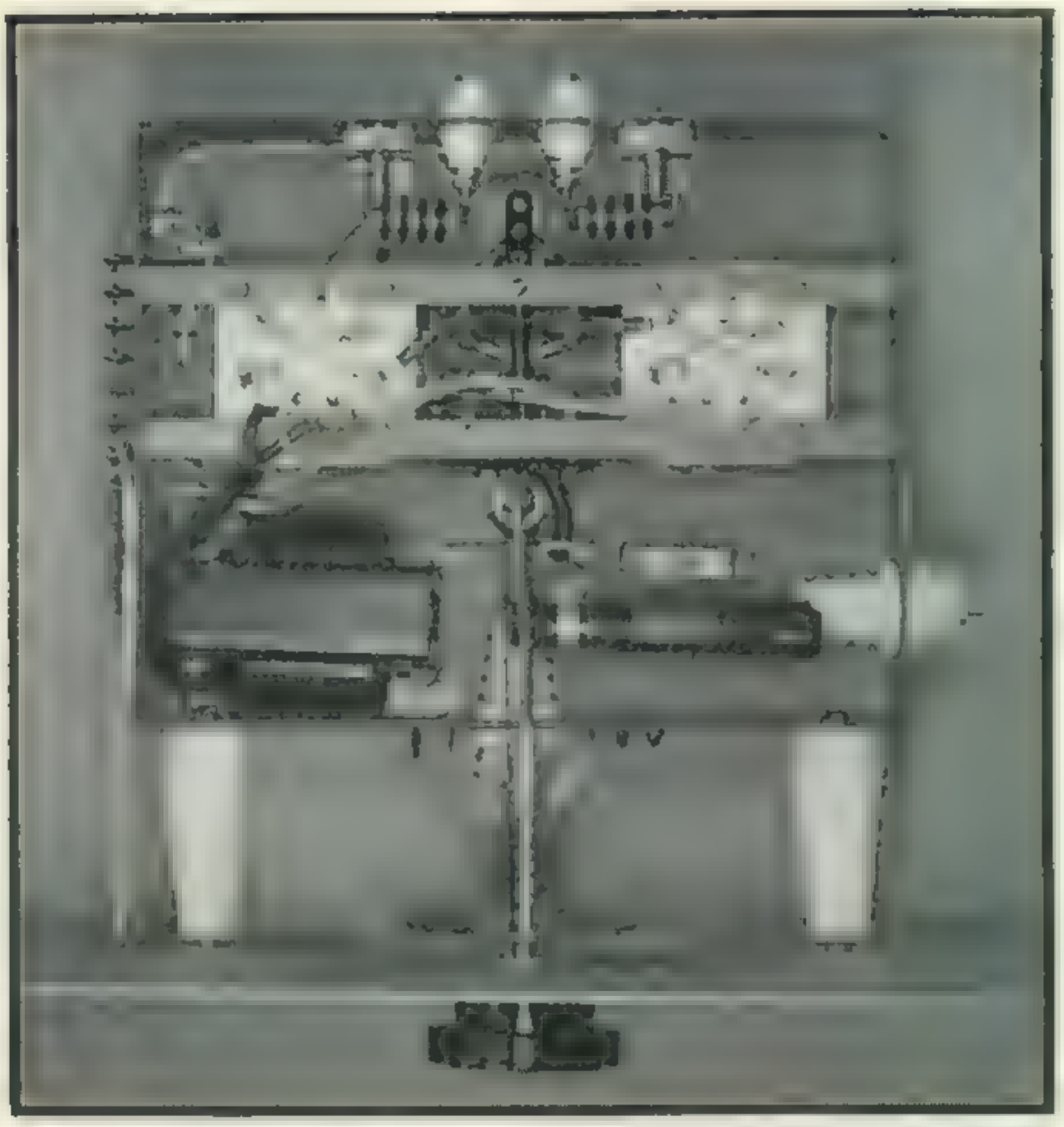
Link Coupling

Tests were run with inputs up to 1 kw using as an exciter a small portable transmitter with a single 6L6 as an output stage.* Sufficient excitation (1.5 ma) was obtained with the 6L6 but slightly loaded. Even though a capacity-coupled amplifier usually requires the preceding stage to be in close proximity to prevent coupling losses which exist in a long capacity-coupled line, it was possible to deliver sufficient excitation with a two-foot link coupling line. It might be said that a coupling line of this type violates conventional

**An All Purpose Portable Transmitter*, Radio, June, 1940



Chassis template



Bottom view showing placement of vacuum condenser mounting block, screen grid dropping resistor, tube sockets, coupling condensers, filament transformer, dial mechanism, by-pass condensers, and other miscellaneous parts

coupling methods, but again easy-to-drive tubes change the picture considerably. The placement of plate circuit components are such that a band-switching turret may be used without making any changes other than the addition of switching contacts in place of the present plug-in connectors.

Mechanical Details

The amplifier is mounted on a 2" x 8" x 10" chassis which also includes the filament transformer. Stand-off insulators with both ends threaded were unobtainable, and those shown were substituted by filling the holes with solder and drilling and tapping the solder. The cylindrical shields which extend down from the bottom of the chassis 1⅛ inch around the base of the tubes complete the shielding between plate and grid circuits. Consideration should be given not only to the upper section of the unit concerning plate leads, but also to the placement of the tubes at the proper distance below the chassis. The lower portion of the shield skirt of the tube should be about level with the top of the chassis. This might be determined simply by placing the tube sockets far enough below the chassis to provide 1⅝ inch clearance between the top of the sockets and the bottom of the chassis. If the chassis and tube socket mounting brackets are made according to the dimensions illustrated the proper distance above and below will exist. In this type of amplifier there should be no "line-of-sight" between grid and plate circuits as self-oscillation will usually result when complete shielding is not incorporated in the design.

It is suggested that in making the condenser mounting block, two pieces of brass be used as shown with the following methods for proper shaping. Firmly clamp the two together with two or three sheets of paper between and drill the horizontal holes. Tap the holes in the stationary piece for an 8/32 thread and drill out the holes on the other piece to clear an 8/32 screw. Drill the 9/16 inch condenser mounting hole while these are still clamped. This will provide a uniform take-up on the condenser mounting base of .007 to .009 of an inch. This will approximate the thickness of the paper that was inserted. All r-f by-pass condensers return to ground at a common point about the center of the chassis which is as close as possible to the tank condenser mounting block. This, however, is good practice in any r-f amplifier and will do much towards elimination of parasitics.

Due to the present shortage of panels and chassis one of each was obtained from the local sheet metal shop. Most every town has some-

[*Continued on page 63*]

Know Your QRM

LOUIS E. De La FLEUR, W8AU*

Anyone tuning across the bands today is likely to encounter various signals which are not readily recognized. The majority of them are automatic transmissions of one sort or another. This article is a brief description of some of the present-day radioprinters and their methods of operation. Radioprinters are not without their application in amateur radio, as will be shown in some novel ideas in articles soon to appear

THERE HAS BEEN CONSIDERABLE comment in the amateur radio field concerning the various signals which have appeared on the air in the past few years and are not readily recognized or classified. They are usually passed off glibly as facsimile or some special circuit without a realization of the actual function of the circuit. It is the purpose of this article to provide a basic explanation of electric printers, explain how they are operated by radio signals, and show some of the problems which have been encountered and the methods used to solve them satisfactorily.

Many amateurs are familiar to a limited extent with the electric printer which has been in use for many years on land-line circuits by the CAA, police departments, and other agencies, and commonly referred to as teletype printers. As most printers are basically the same but differ primarily in the code used, the teletype printer will be used for purposes of illustration.

The Teletype Printer

For printer operation, the alphabet, numerals, punctuation, and other characters must be given individual code sequence to differentiate one character from another, just as the International Morse code provides a special code sequence of dots and dashes for each character for aural or visual signalling purposes. In the International Morse code, the length of the code sequences varies from one dot for the letter "E" to five dashes for the figure "Ø" and such an unequal code system presents serious difficulties to mechanical interpretation. Consequently, equal-unit codes were developed for mechanical printer operation and some form of equal-unit code is used by all present-day printers.

In the teletype system, each character is assigned five units of time to be use l for its transmission so that the letter "E" takes just as long to send as the figure "Ø." What distinguishes one character from another is the sequence in which these five units of time are pulsed. In printer terminology, when a time unit is pulsed or carries current, it is said to be "marked" and when it is not pulsed, or carries no current, it is said to be "spaced." Depending upon how the circuit is set up to operate, it could actually use current-on or current-off to mark. *Figure 1* shows the Teletype code for the more common keyboard arrangements and those units carrying numerals may be said to be marked and the blank ones spaced.

*149 Upsla S.E., Washington 20, D. C.

A. T. & T. CO. L. L. DEPT — TELETYPEWRITER CODE CARD — FORM P1429 — #14 #15 — TAPE AND PAGE TELETYPEWRITERS — TAPE

| | | |

Synchronization

Since these printers operate on a time basis, the receiving and transmitting units must be in synchronism, and this may be accomplished in two ways. The start-stop printer, in which the printing speed is continuously variable from zero words per minute to the maximum capabilities of the machine, uses two additional time units, one before and one after the five units of the selecting code, to provide synchronism. The first unit then starts a scanner, or distributor, which scans the next five units and distributes the marking or spacing pulses to relays which control a lever-gate system and the last, or seventh, time unit stops the scanner in a position ready to start scanning again as soon as the next character is sent. The lever-gate system in a Teletype printer consists of five notched bars, one for each unit of the selecting code, which are slid back and forth by relays and, in effect, control the printed character.

The second method of synchronization requires the continuous rotation of the scanners, or distributors, and involves rather elaborate equipment to maintain synchronism. The use of a prepunched tape to key the transmitting system is a "must," and the machines are usually operated at or near their maximum speed capabilities.

Teletype printers usually operate with a top speed of approximately 62 or 75 wpm. The International Business Machines Corporation has a printer which operates at a continuous maximum speed of 100 wpm, using a six-unit selecting code, and the Radio Corporation of America has a printer which normally operates at 62 wpm and uses a seven-unit selecting code.

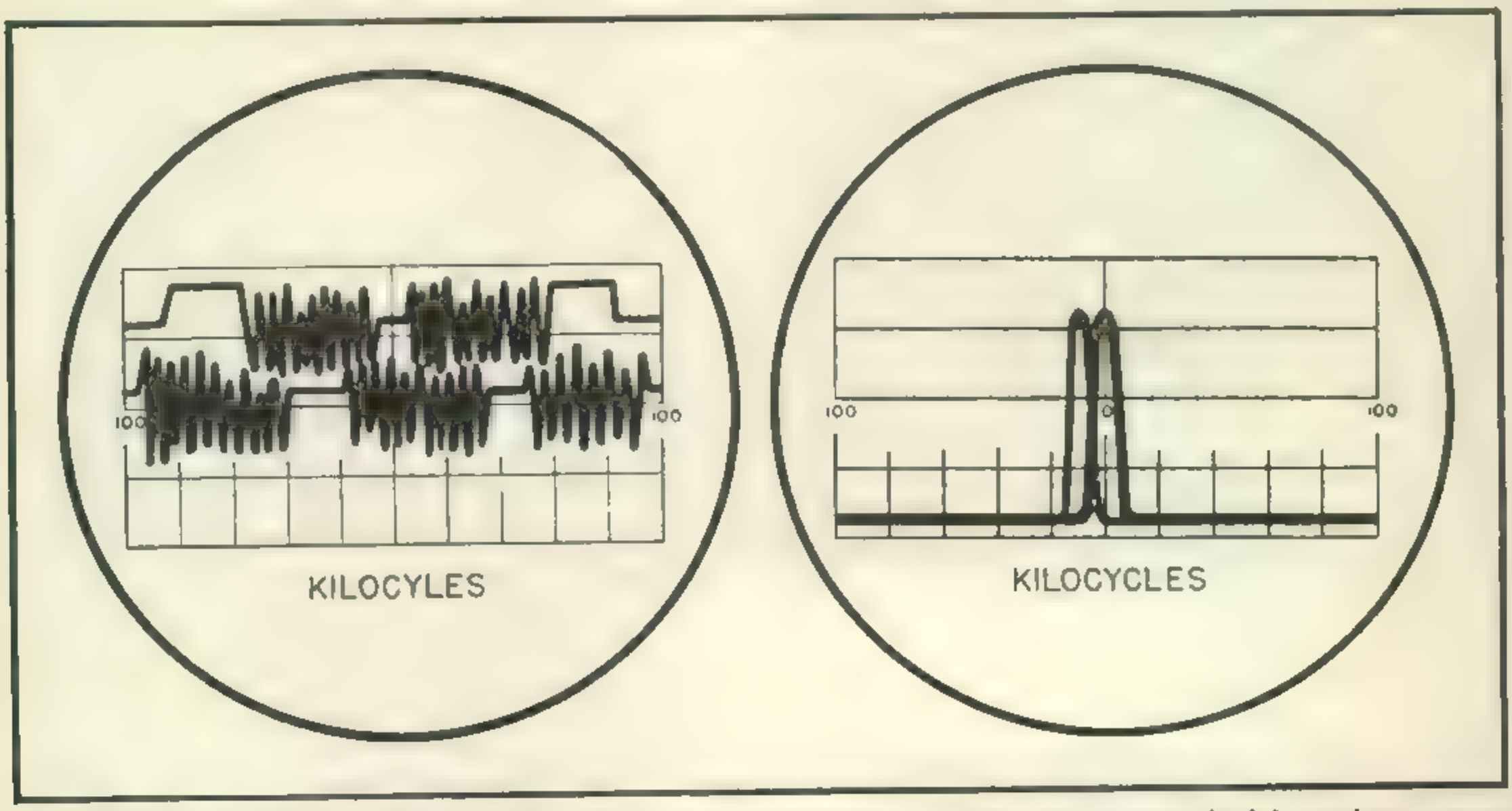
One of the reasons RCA went to a seven-unit selecting code is that each character can then be composed of its own sequence of three marking and four spacing units. Consequently, the printer can be designed in such a way that it will not print a false character if two or less, or four or more, marking units are received. Such a condition may conceivably be brought about by fading, static crashes, or interference of various sorts.

Most printers on land-line circuits are used as closed-circuit printers, i.e., the circuit is normally closed and current flows through it while the printers are in the resting position. They can, however, be used as open-circuit printers with generally satisfactory results but without some of the advantages of closed-circuit operation.

Radioprinters and Selective Fading

It is not too difficult to visualize the transition from wired printers to radioprinters. Carrier-on can be made to perform the same functions as current-on and our radioprinters may be made to operate in this rudimentary fashion. But a simple radio circuit is subject to many variations and hence is not as reliable a medium of communication as a wire circuit. Great strides have been made in the past few years to improve the reliability of radio circuits and it is largely because of these comparatively recent developments that radioprinters are practical and satisfactory.

Selective fading, where all portions of a modulated carrier do not fade simultaneously or with equal severity, has been recognized for many years, and our knowledge of selective fading has now been put to use on radio circuits using both the International Morse code and radioprinters. One form is in the use of carrier-shift circuits



Carrier shift automatic transmission views taken from Panadaptor. (Left) zero sweep, (right) medium sweep

which may offer possibilities for experimentation by the inquisitive amateur in the v-h-f range. It may be compared somewhat to the old compensated keying used on arc transmitters years ago, except that the backwave was not used for communication purposes then unless the receiving operator happened to be unusually adept at copying it.

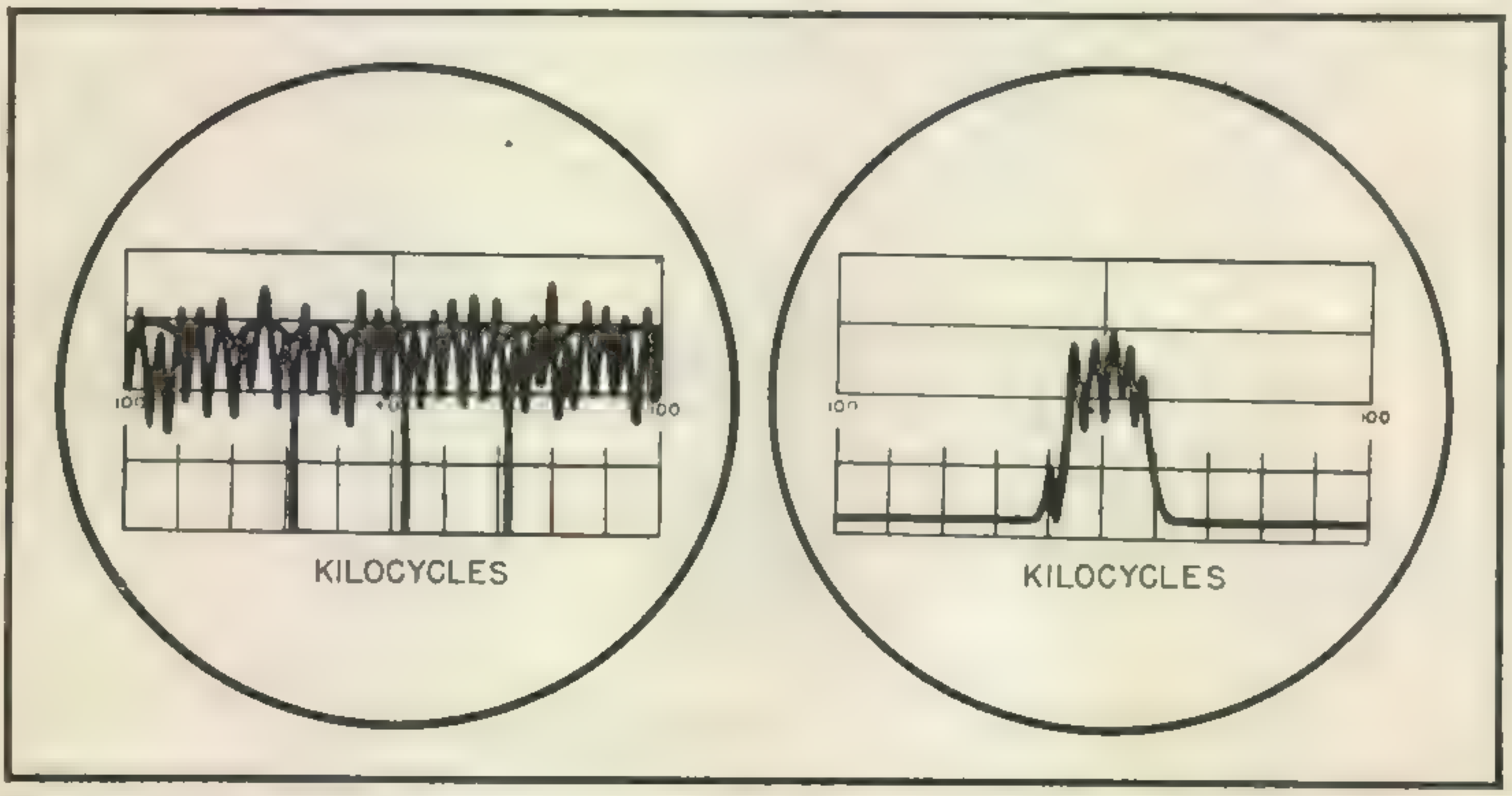
With a carrier-shift circuit, the transmitter is emitting a carrier at all times. When no traffic is being sent, the carrier is steady on one frequency but as soon as traffic is being handled, the frequency shifts to a slightly different value in accordance with the pulses of the characters being transmitted. This new, or shifted frequency is in the order of four or eight hundred cycles away from the resting frequency, depending upon the standards of the service which operates the circuit. A shift of that amount is all that is required since it has been determined that there is little, if any relationship between fades on frequencies five hundred cycles or more apart. Thus, a form of diversity reception is inherent in this system, provided both the resting and shifted carriers are used. This is accomplished by inverting the phase of the output from one of the carriers and combining it with the output from the other carrier. Then, if one of the carriers fades, the other will continue to operate the printer. This feature is so important that its use is not restricted solely to radioprinter operation, but it is being used on very high speed International Morse circuits where one fade might wipe out a message.

Since a carrier-shift circuit operates basically on a change in frequency rather than on a change in amplitude, it also possesses desirable characteristics inherent in frequency-modulated radiotelephone circuits. For example, a discriminator-type detector, dependent upon frequency change for its operation, may be utilized along with cascaded limiters ahead of it, thereby producing satisfactory performance at almost unbelievably low signal-to-noise ratios. Performance is further improved on low signal-to-noise ratio circuits by the use of very sharp filters which reject a large percentage of the noise passed through previous wider-band stages of the receiving equipment.

By using the advantages discussed above, plus space-diversity reception where needed, it is not difficult to understand how such a circuit may be made to perform with reliability approaching that of a wired circuit and satisfactorily handle radioprinters.

Multichannel Systems

The American Telephone and Telegraph Company has approached the problem in a slightly different manner and has produced a system which has many desirable features. Their system uses a steady carrier which is amplitude-modulated by a series of audio tones which carry the printer pulses. Four tones are usually used for each printer, two to mark and two to space, and these four tones are spaced as widely as is practicable. Reception of any one of the tones is sufficient to operate the printer. Because of the modulation impressed on the carrier, the signal would be rather broad to handle only one circuit, so twelve or twenty-four tones are used to operate three or six independent radioprinters on the one carrier. One sideband may be suppressed, or used to perform an entirely separate



High speed code automatic transmission views taken from Panadaptor. (Left) zero sweep, (right) medium sweep

function such as to carry a radiotelephone circuit or another set of three or six radioprinters, thereby providing maximum utilization of the assigned frequency channel.

A circuit carrying more than one radioprinter on a single carrier is usually referred to as a multichannel circuit. The A.T.&T. system just described is a multichannel system which depends upon audio filters for separation of the various channels. Other systems of obtaining multichannel operation have been developed and will be briefly described.

Amplitude, frequency, phase and time are four parameters which may be utilized in various relationships to convey intelligence on a radio circuit. Amplitude and frequency modulation are well known to the average amateur. Phase modulation is used extensively in crystal-controlled mobile transmitters, and because it is somewhat similar to frequency modulation, it is frequently referred to erroneously as frequency modulation. The time element enters into all the systems in one form or another and lends itself admirably to multi-channel radioprinter operation.

Suppose we desired to transmit pulses from two printers over one carrier for simultaneous radioprinter operation. It could be done by feeding the pulses to brushes and picking them off by a rotor in much the same manner as a distributor on a car feeds a spark to the proper spark plug at just the right instant. Whether there was a marking or spacing pulse on the brush as the rotor passed it, would then determine whether the carrier would be on or off. A similar distributor arrangement in exact synchronism with that at the transmitter would be used at the receiving point to feed the pulsed carrier alternately to one printer and then the other. If a five-unit selector code were used by the printers, five revolutions of the rotor would be required to transmit one complete character on the two channels.

This is basically the system which is used in actual practice, with certain refinements to provide the desired conditions. For example, one system maintains synchronism by carrying a constantly recurring synchronizing pulse on one

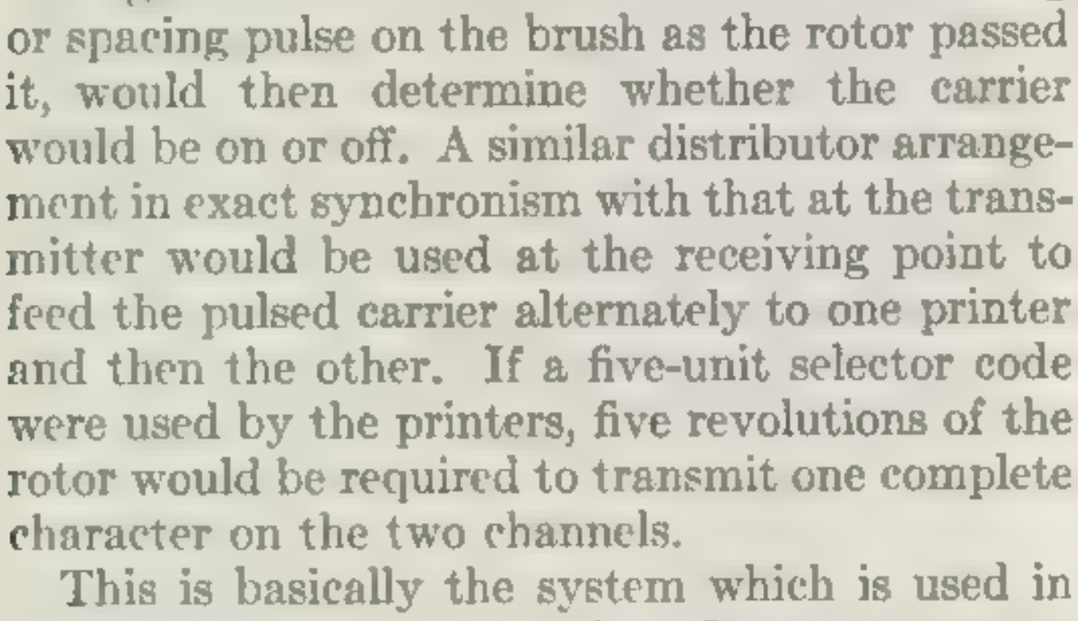


Fig. 2. Mark and space cable code combinations as used on radioprinters; (a) transatlantic cables, (b) one channel of a radio printer, (c) the second channel of a radio printer

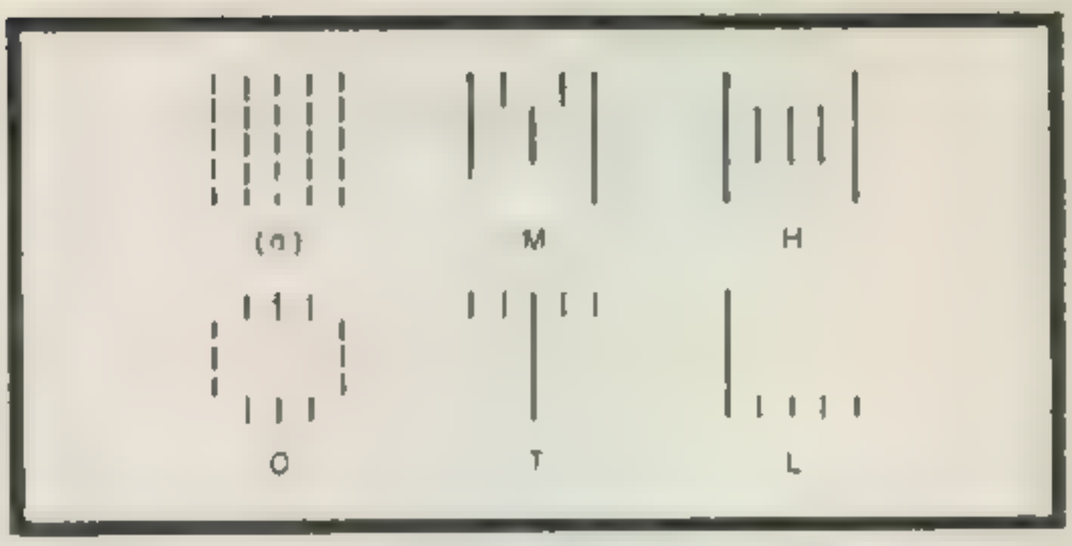


Fig. 3. Helleschreiber characters. (a) illustrates all twenty-five units marked. Other examples show how characters are formed

of the brushes. The RCA system maintains synchronism automatically, once it has been established, and then uses only one-tenth of the total pulse to operate the printer. This is done to minimize the chance that a false pulse will be produced by static or external noise or interference. Multichannel systems of this type are characterized by a pulsing rate two, three or four times as great, approximately, as a corresponding single channel system, depending upon whether it is a two, three or four channel system. More than four channels may be used on one carrier, the limit probably being determined by the multipath characteristics of the frequency used and the mechanical ability of the printer equipment to set up on each pulse and print before another series of pulses is fed to the same printer.

PTM

The wraps have only recently been removed from another system of multichannel operation known as Pulse-Time Modulation. In this system, a constantly recurring marker pulse is transmitted, followed by a series of pulses which carry the intelligence of the various channels. The intelligence pulse may be nearer to or farther from the marker pulse (on the time axis) and its position relative to the marker pulse determines the intelligence. Such a system may be used for radioprinter operation but it is unusually well suited for multichannel radiotelephone operation and may be used largely on that type of circuit.

The British have used an adaptation of the cable code on radioprinters for many years, developed by Higgitt. The cable code is basically an equal-unit code but of a type differing from that used on the printers already described, in that the dot, dash and space are each broken up into two equal time elements, while the other printers broke the letters, numerals and other characters into a series of equal time elements. A limited number of mark and space pulse combinations exist for the dot, dash and space elements of the International Morse code and any of the possible combinations shown in *Fig. 2* may be used. This type of printer is generally used on a two-channel circuit, using the distributor system

{Continued on page 61}

Cathode-Coupled Amplifier for
PANORAMIC ADAPTORS

J. R. POPKIN-CLURMAN, W2LNP*

An improved method for connecting panoramic adaptors to standard communications receivers

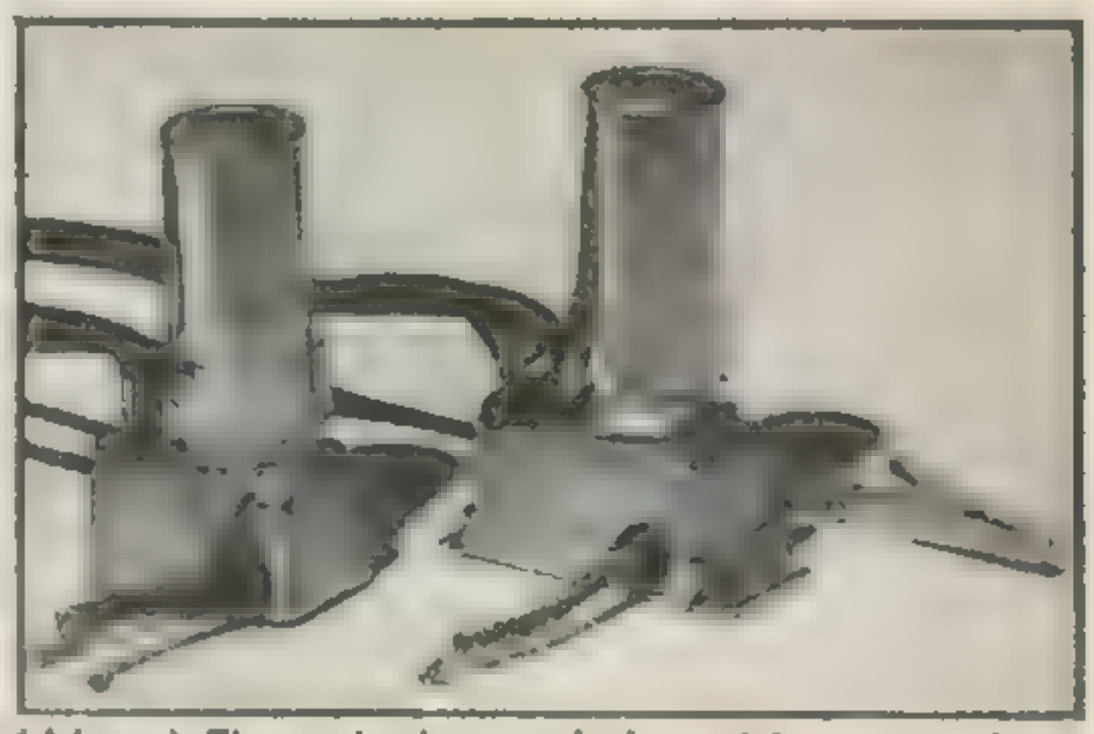
ORDINARILY a Panadaptor is connected to its companion receiver by means of a shielded cable connected through a fixed resistor at the plate of the receiver converter tube. The resistor is necessary to prevent the capacity of the connecting cable from detuning the first i-f transformer in the receiver.

While operation under these conditions is generally suitable, the resistor in the panoramic coupling lowers the Q of the first i-f coil, so that the gain of the first i-f stage is somewhat reduced. In most cases this reduction in gain is not serious. However, when the receiver is continuously operated at maximum gain, such reduction in sensitivity may be undesirable.

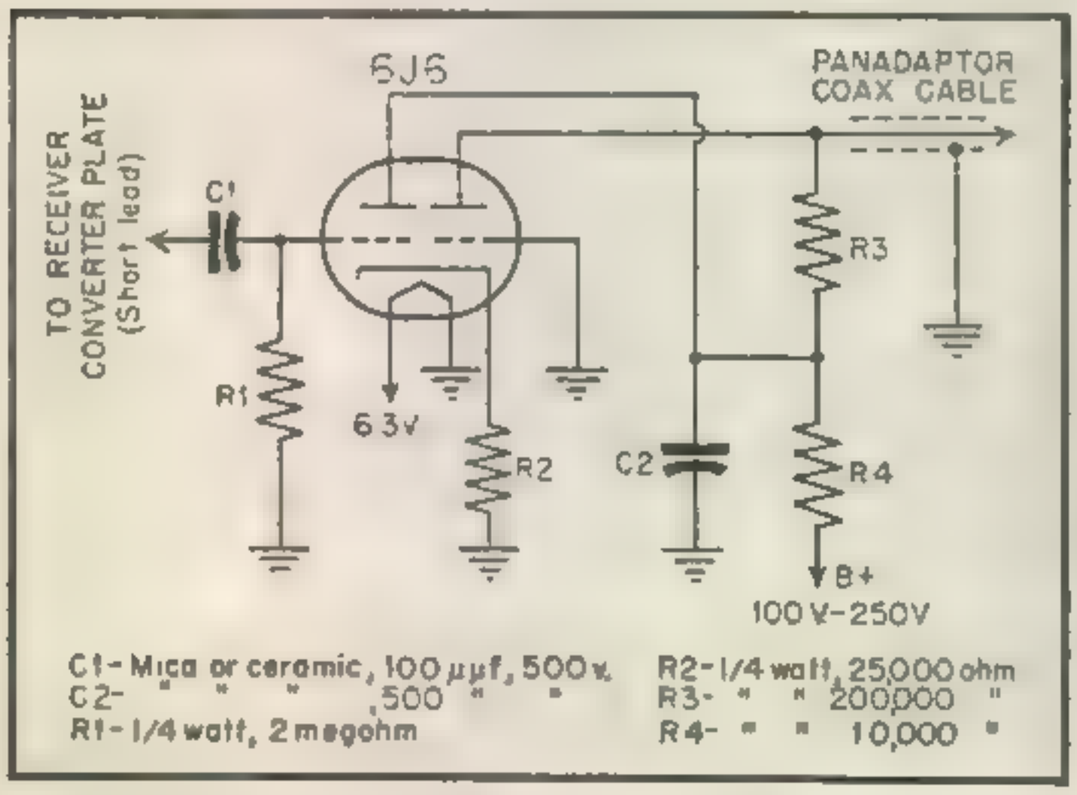
In order to overcome this condition and to make it possible to connect a panoramic adaptor to a receiver without affecting the receiver in any way, use of the following cathode coupled amplifier is suggested:

This circuit requires no change in the adaptor or its cable and results in a substantial increase in adaptor gain. A double triode of the miniature type should be used. The circuit component values shown in the diagram are for a 6J6. If the coupling system is mounted on the chassis of the receiver, it should be brought as close as possible to the plate of the converter tube and the connection to the plate terminal of the converter made with as short a lead as possible. However, if the circuit is not permanently in-

[*Continued on page 56*]



(Above) The cathode coupled amplifier is simple to construct. These two slightly different versions are typical examples. (Below) Bottom view of cathode coupled amplifier. Placement of components is not critical



Circuit diagram of cathode coupled amplifier

**Panoramic Radio Corp., 250 W. 55 St., N.Y. 19, N.Y.*

A Compact Oscilloscope

CHARLES T. HAIST Jr., W6TWL*

Once you are familiar with its many applications, one of the handiest gadgets around the shack is the oscilloscope. This compact, inexpensive unit just fills the bill for the average amateur station

THIS ARTICLE describes a compact, light, and highly serviceable oscilloscope which is particularly suited to portable application. It may be used for checking modulation percentage and linearity, signal tracing and trouble shooting, frequency checking, as well as other applications for which the usual scope is adapted.

The first steps in the construction of the scope are the drilling of the cabinet, chassis, and placement of components. These operations are not difficult, and the sketches with dimensions are self-explanatory. The general appearance of the finished job, which weighs only nine pounds, is clearly shown in the photographs.

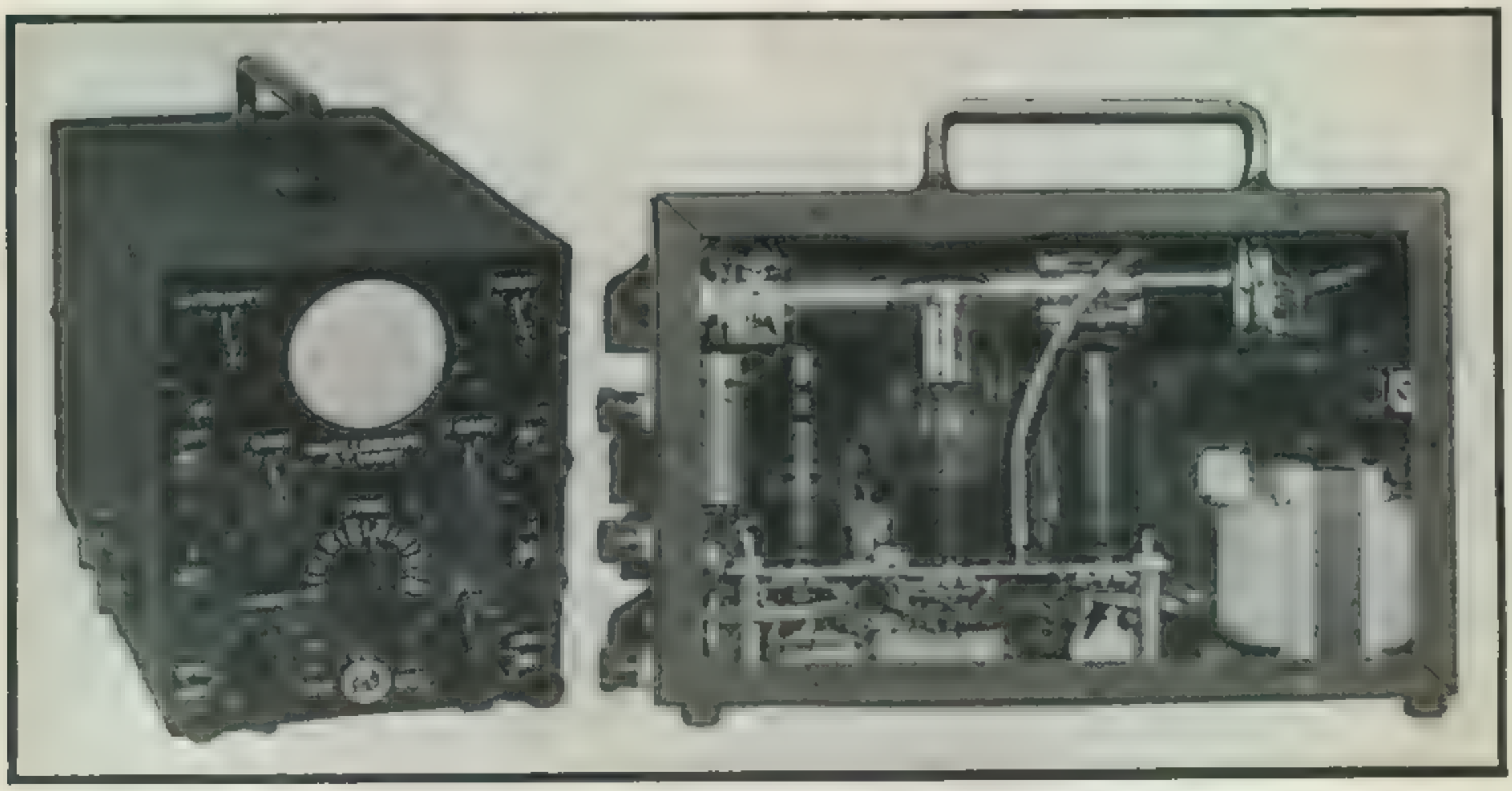
The cathode-ray tube used is a 902 with two-inch screen. The high-gain amplifier stages, using 6J7 tubes, have good frequency response from 10 to 100,000 cps. The sweep generator uses an 884 tube in a relaxation circuit, with a repetition rate of 15 to 30,000 cycles.

*743 Warfield Avenue, Oakland 10, Calif.

Controls

Front panel controls are: *R1*, the vertical input gain control, which is ganged with the vertical input switch *S1*. *R*, the horizontal input control, is similarly ganged with the horizontal input switch *S2*. (See *Fig. 1.*) *S3* is the sweep range selector switch, the six sweep positions cover approximately 15-60, 60-220, 220-0.9K, 0.9K-3K, 3K-10K, and 10K-30K. Each position is overlapped by the sweep frequency vernier control *R12*. *R7* is the sweep synchronizing or locking control. *S5* is the switch for external or internal synchronization. *R26* is the CR tube focusing control. *R28* is the intensity control ganged with switch *S4* for power "off-on."

On the left side of the panel are *R19* and *R20*, the horizontal and vertical centering controls.



(Left) Compact oscilloscope has professional appearance by using commercial engraving on front panel. Layout may be taken from Fig. 2. Standard components are used throughout. (Right) Looking into side of scope shows absence of haywire despite compactness. Mechanical layout should be carefully duplicated to avoid mounting difficulties

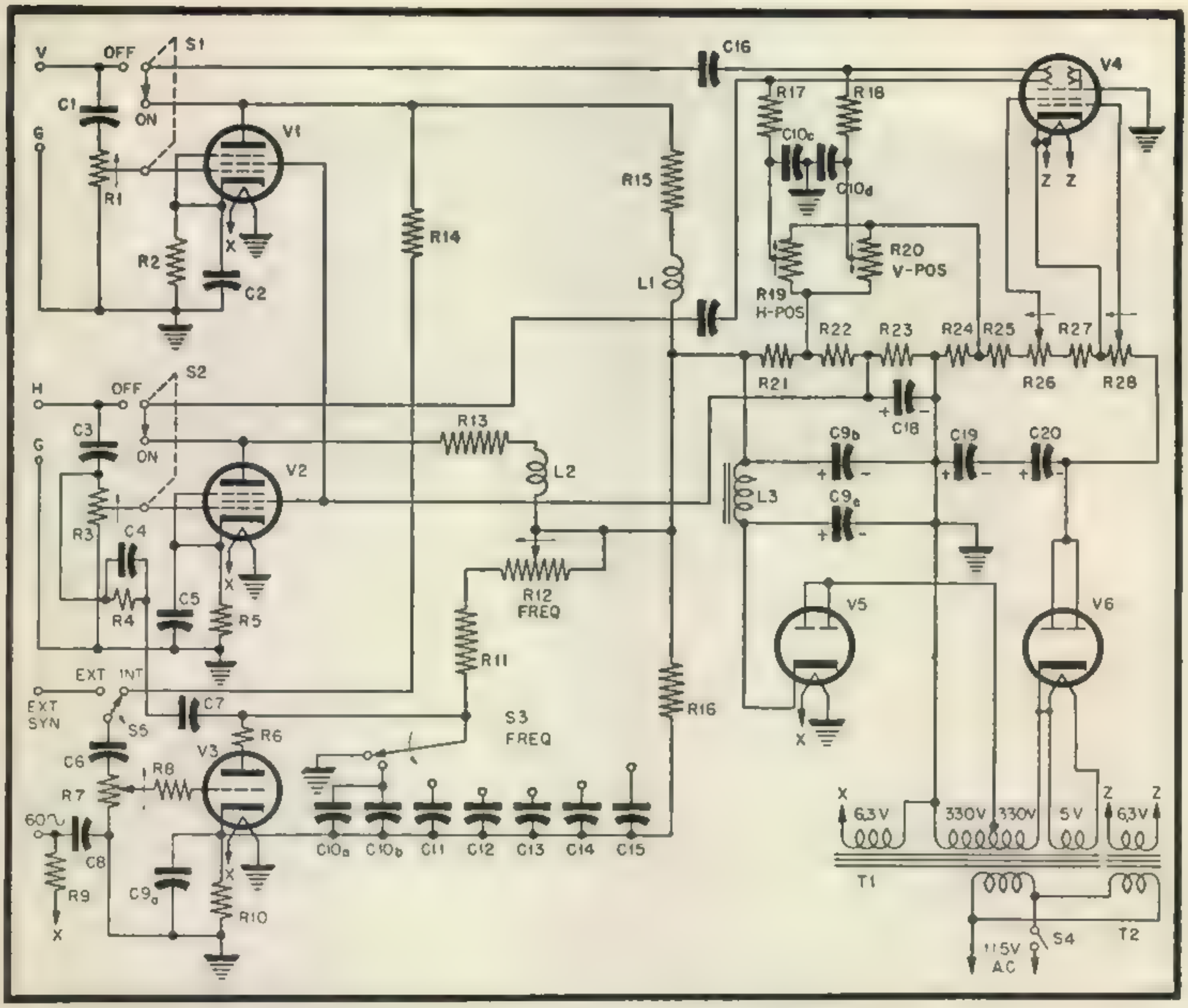


Fig. 1. Circuit diagram of the compact oscilloscope.

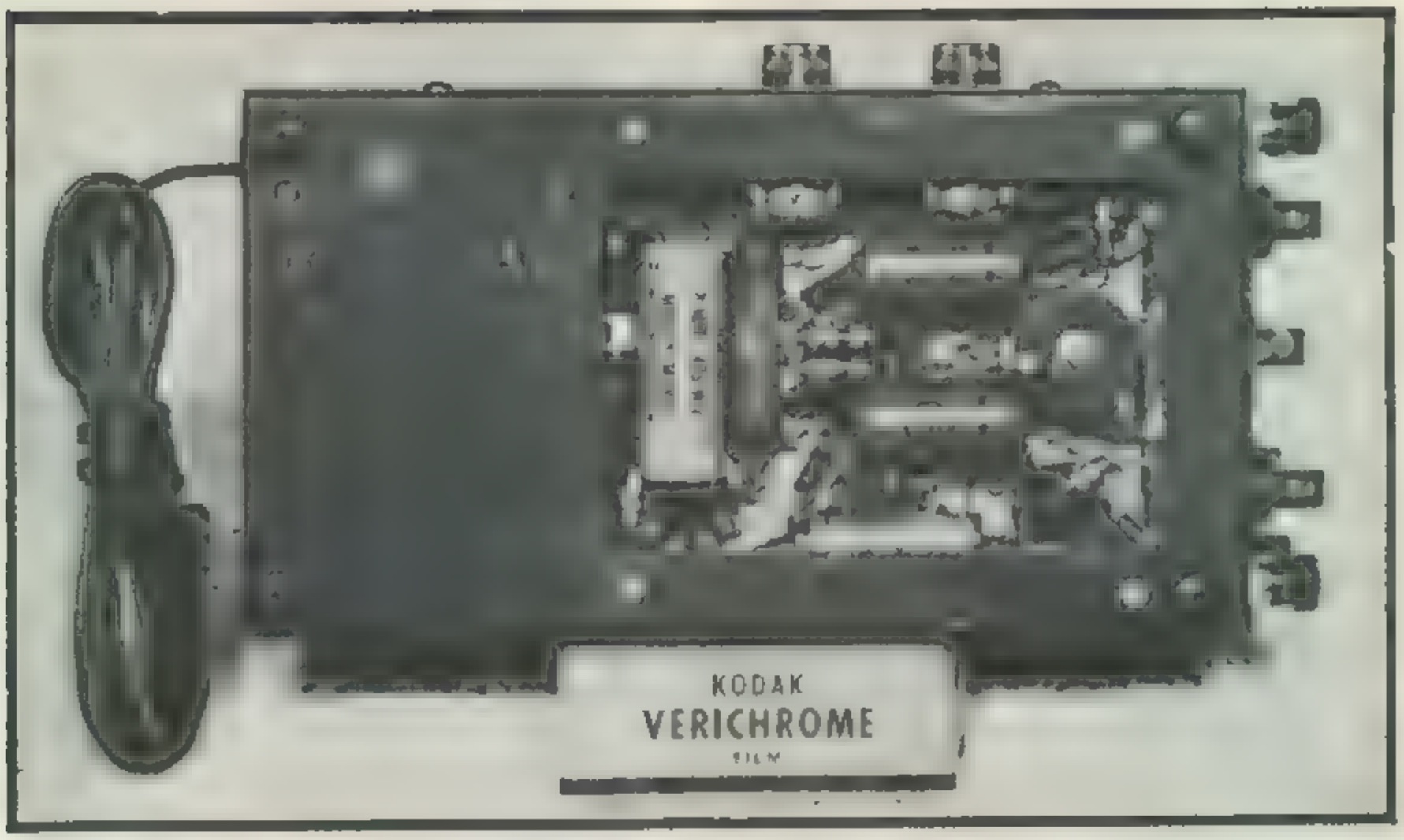
PARTS LIST

C1, C3, C8, C10a, C10b—.1 μf, 450 v. paper
C2—.002 μf, 450 v. mica
C4—3-30 μf, ceramic trimmer
C5—.004 μf, 450 v. mica
C6, C7—.05 μf, 450 v. paper
C9a—25 μf, 50 v. electrolytic
C9b, C9c—10 μf, 450 v. electrolytic
C10c—.05 μf, 450 v. paper
C11—.04 μf, 450 v. paper
C12—.01 μf, 450 v. paper
C13—.0025 μf, 450 v. mica
C14—.0006 μf, 450 v. mica
C15—.000125 μf, 450 v. mica
C16, C17—.25 μf, 450 v. paper
C18—8 μf, 450 v. tubular electrolytic
C19, C20—10 μf, 450 v. tubular electrolytic
R1, R3—1 meg. potentiometer
R2, R5—750 ohm, ½ watt
R4—2 meg. ½ watt
R6—500 ohm, ½ watt
R7—15,000 ohm potentiometer
R8, R13, R15, R27—100,000 ohm, ½ watt
R9—10,000 ohm, ½ watt
R10—1000 ohm, ½ watt
R11—500,000 ohm, 1 watt
R12, R19, R20—4 meg. potentiometer
R14—1 meg., ½ watt
R16—100,000 ohm, 2 watt
R17, R18—5 meg., ½ watt
R21—25,000 ohm, 10 watt
R22, R23—10,000 ohm, 3 watt
R24—200,000 ohm, 1 watt
L1, L2—60 mh choke
L3—5 h, 40 ma choke
S1, S2—SPDT, on R1, R3
S3—SP7 position rotary
S4—SPST power
S5—SPDT toggle
T1—330-0-330 v. @ 40 ma, 5 v. @ 2 amps., 6.3 v. @ 2 amps. transformer
T2—6.3 v., 1 amp transformer
V1, V2—6J7
V3—884
V4—902
V5—6X5
V6—5Z4
Cabinet—Bud CU1099

L1 and *L2* are shunt compensation coils in the plate circuits of the 6J7 tubes, to extend the upper frequency limit.

Power Transformer

One reason for its compactness is the small standard receiver replacement power trans-



Bottom of scope is accessible through cutout. Power supply occupies rear section of cabinet. Besides serving to balance the scope for the photo film, box gives further idea of size of oscilloscope

former used to furnish the high voltage for the scope and amplifiers. One end of the secondary is grounded and the other end is connected to the filament of the 5Z4 for half-wave rectification of half the total voltage, or 330 v.

A separate 6.3-v. filament transformer is used for the 902 filament since the tube cathode is at high negative potential. Another advantage of the separate filament transformer is that its stray magnetic field can help cancel the stray field from the power transformer, as described later.

Two 10 μf, 450-volt condensers connected in series were used in the filter of the high voltage supply. The rest of the circuit is conventional.

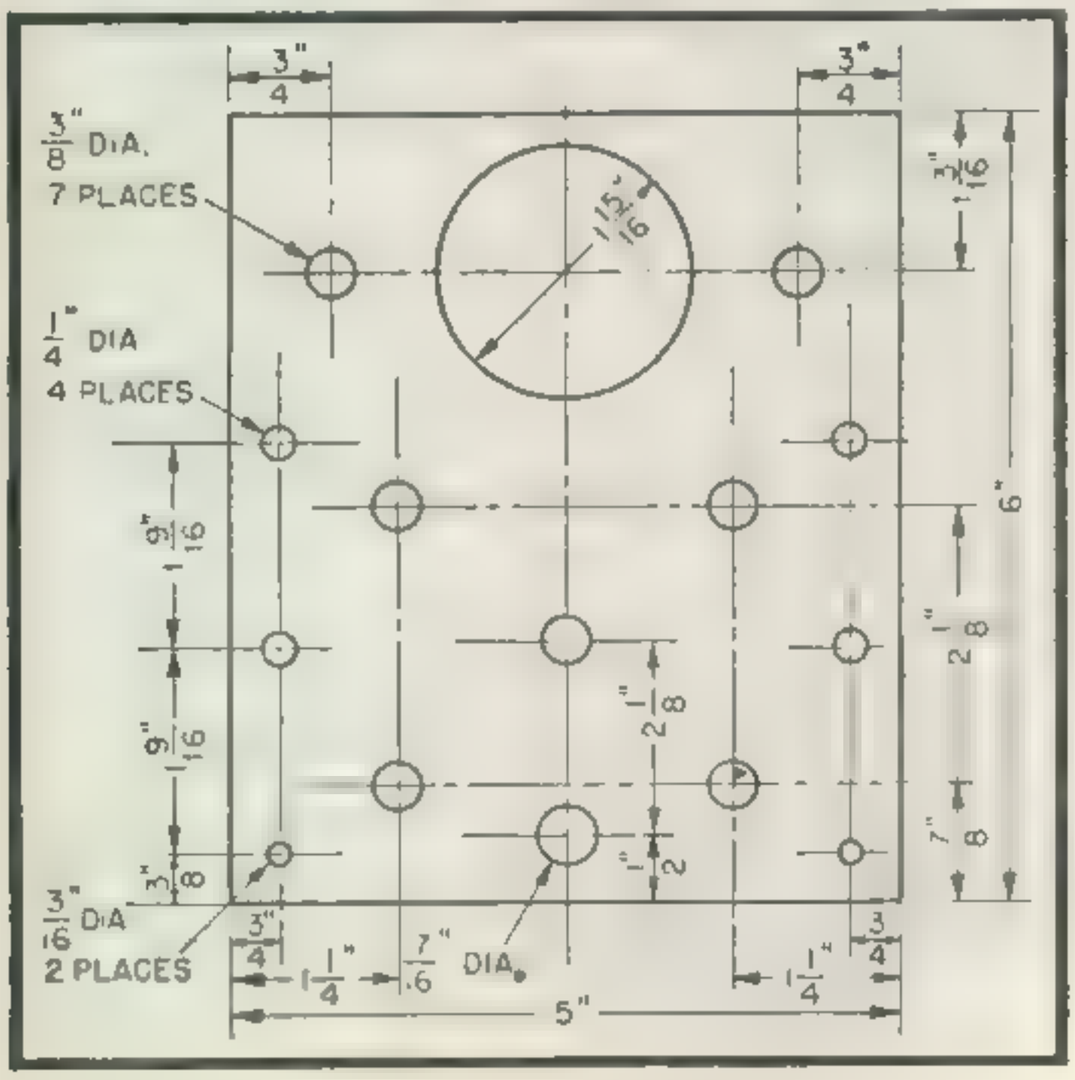
Cabinet

The cabinet used for the oscillograph is a standard commercial unit. A template, as shown in *Fig. 2.* was used to determine the position of the controls on the front and for drilling the holes. The template was also used for laying out the engraving on the bakelite panel. The engraved panel was held on by the shaft nuts of the various controls. The two knobs on the left side of the cabinet are for the vertical and horizontal positioning controls. In the bottom of the cabinet an opening of 3 3/8" x 5" was cut. With the two sides removed, and the opening in the bottom, all parts were accessible for wiring and replacement.

Chassis

A piece of 1/16" aluminum 4½" x 5" provided the chassis for the instrument, (see *Fig. 3*). The chassis is supported from the bottom of the cabi-

[*Continued on page 59*]



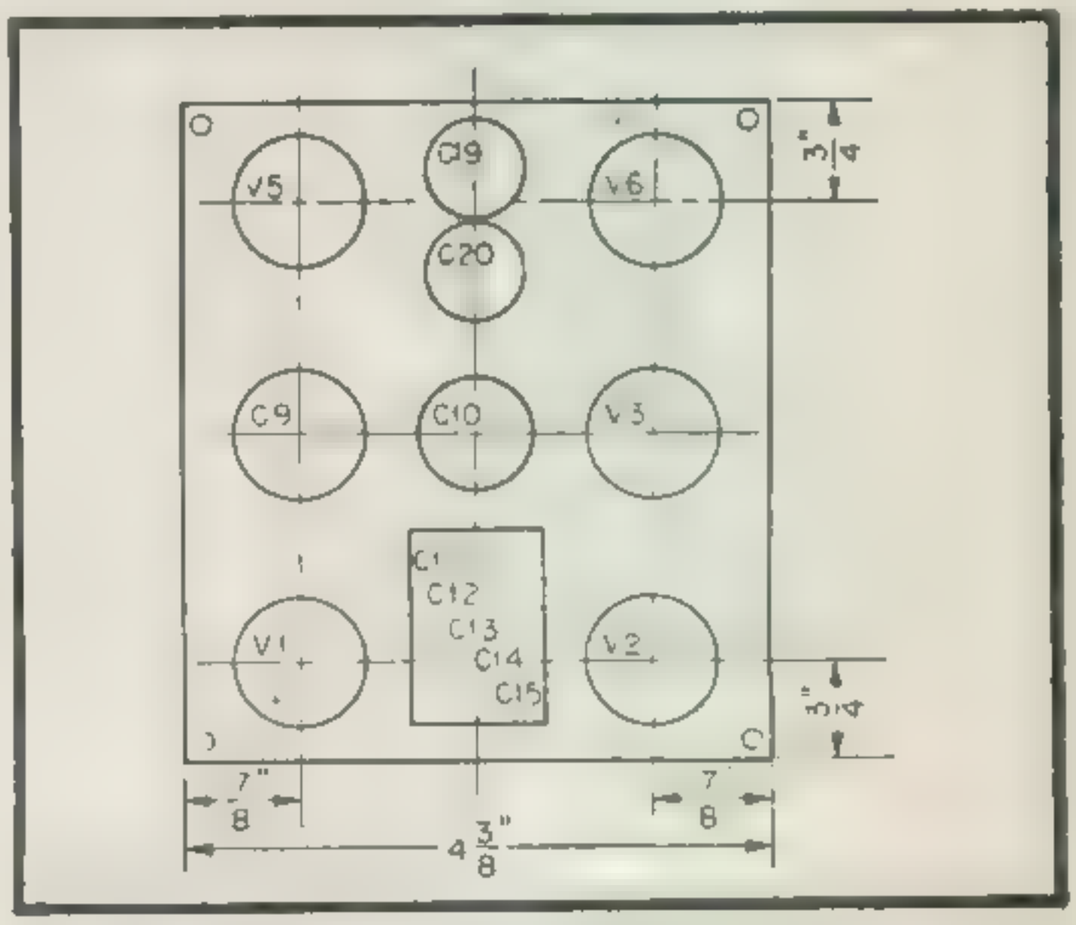


Fig. 2. (left). Template for drilling front panel and laying out engraving. Fig. 3. (above). Template for chassis layout and drilling

MATCHING STUBS
for VHF Antennas

LOYAL STEPHEN FOX, ex-W2AHB*

THE TYPE OF TRANSMISSION line and associated matching stub to be considered here is the untuned or "flat" open-wire line used to convey r-f energy from a transmitter to an antenna. The theory and mathematical equations pertaining to such lines and stubs have been dealt with extensively elsewhere and so need be covered only to obtain an understanding of the basic principles.

Any transmission line will have inductance and capacitance—and therefore impedance, which is called the "characteristic" or "surge" impedance. For open-wire lines this impedance depends upon the diameter and spacing of the wires, and is given in *Table 1*. Note that the impedance remains the same regardless of the length of the line. Suppose the line shown in *Fig. 1* has an impedance of 500 ohms; then the impedance of section *a* is also 500 ohms, likewise the impedance of section *b* is 500 ohms. So we can say that section *a* "looks into" an impedance of 500 ohms. Therefore, as in *Fig. 2*, we can replace section *b* with a resistance of 500 ohms. We have then terminated the line with a resistive load which matches the line impedance.

Fig. 3 represents a rope to which a vibratory motion is imparted at point *a*, while the other end at *b* is rigidly fixed. The motion imparted at *a* is reflected back from *b*, causing standing waves to appear on the rope. In *Fig. 4* the rope is suspended between two springs at *b*. Since the motion is completely absorbed by the springs, none is reflected back. *Fig. 4* is analogous to a "flat" transmission line terminating in a matched load, while *Fig. 3* represents the standing waves on an unmatched line.

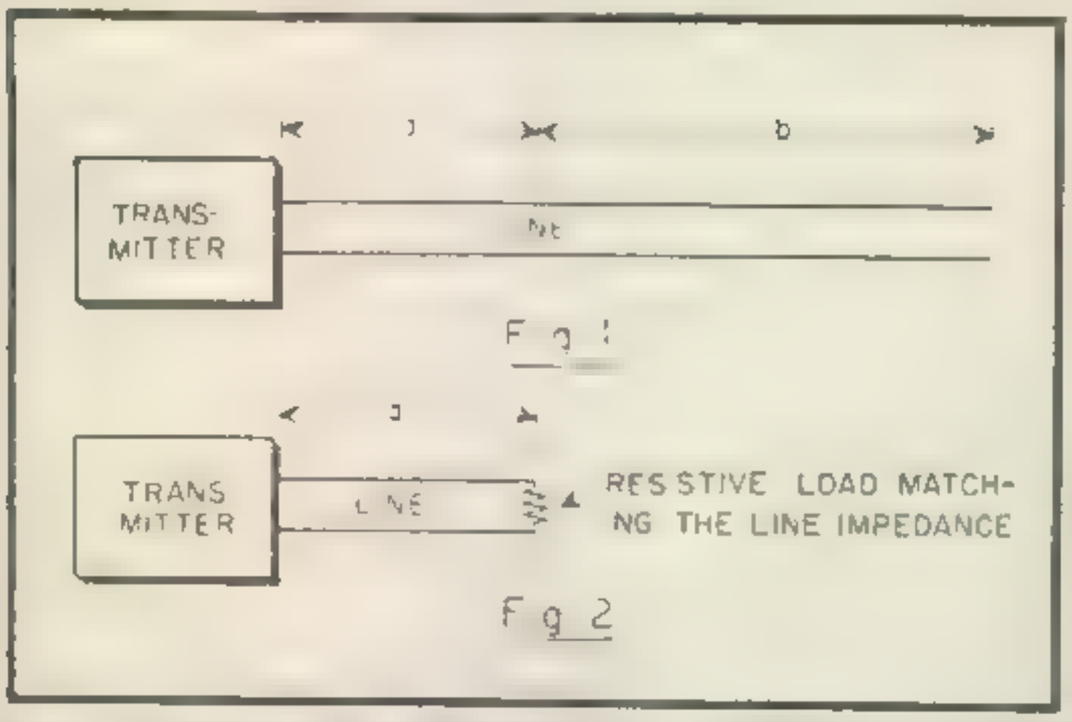
Wire size	Spacing 1"	1½"	2"	2½"	3"
8	330	380	415	450	465
10	360	410	440	470	490
12	385	435	470	500	520
14	410	460	495	520	545
16	440	490	520	560	575
18	470	515	550	580	600
20	495	545	580	610	630
22	525	575	610	640	660

TABLE 1
Characteristic impedance of 2-wire lines — in ohms.

Matching Impedances

The problem is to match a line of say 500 ohms into a load (antenna) of say 70 ohms so that the line will be "flat"; that is, will have no standing waves on it. When in that condition, the maximum amount of power will be transferred from the line to the antenna. A device frequently used to solve this problem is the closed-end matching "stub." This is a simple affair, made of the same

88-39 213th St. Queens Village, N. Y.



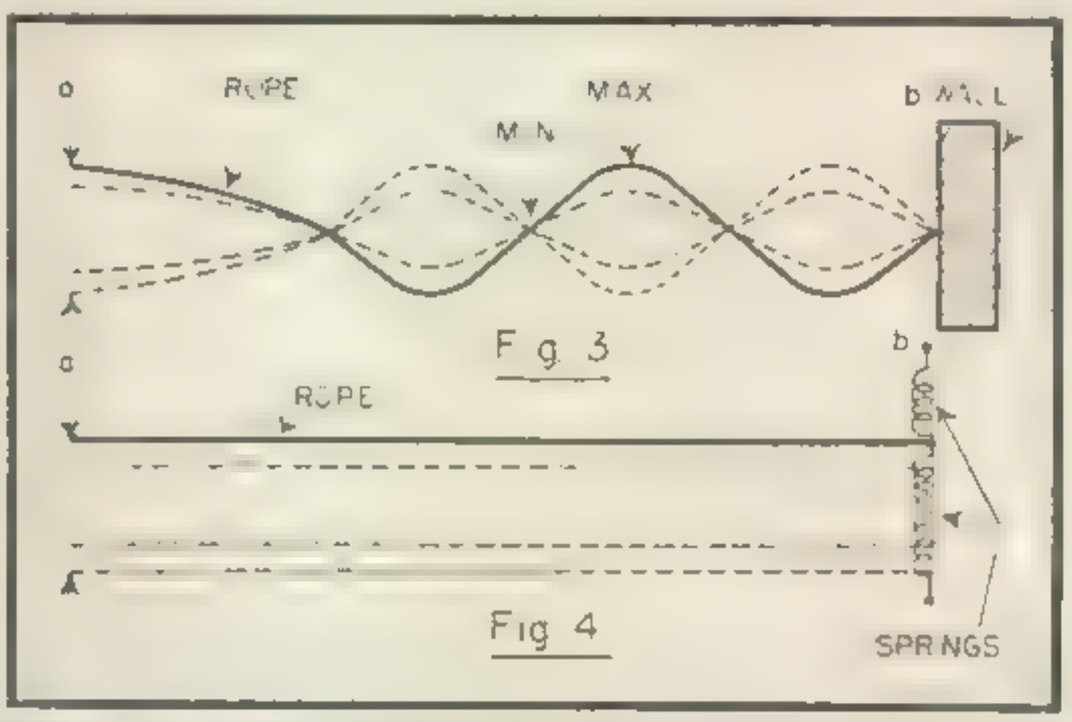


Fig. 1. Standard transmission line, unaffected by length, derives impedance from diameter and spacing of the wires. Fig. 2. Line can be terminated in a resistor of value equal to impedance. Fig. 3. Reflection of rope motion with one held rigid causes "standing waves" to appear. In Fig. 4 the rope is suspended between two springs at b. Since the motion is completely absorbed by the springs, none is reflected back. Fig. 4 is analogous to a "Flat" transmission line terminating in a matched load, while Fig. 3 represents the standing waves of an unmatched line

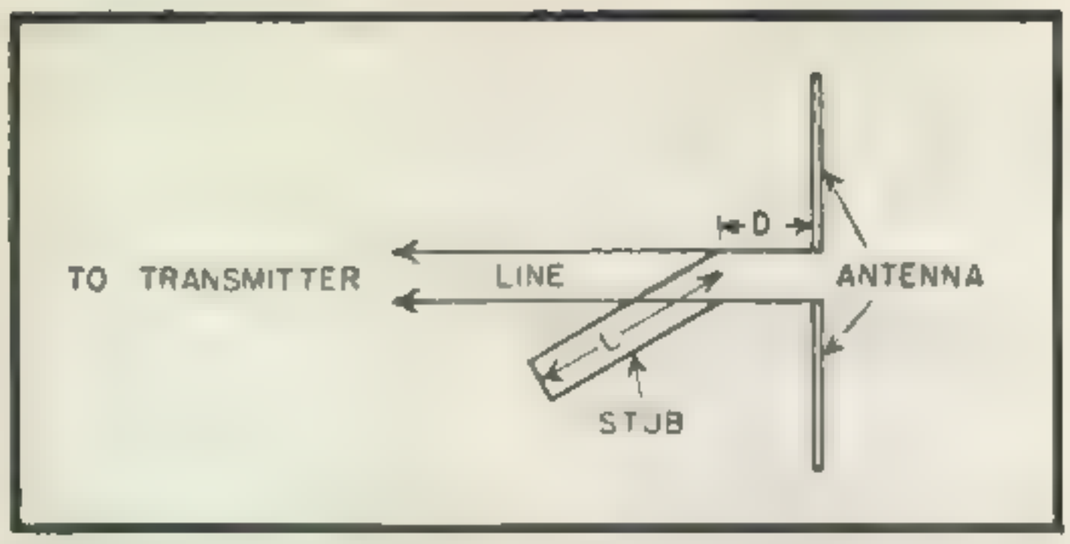


Fig. 5. Typical matching stub to eliminate standing waves. Dimensions D and L are given in Table 2

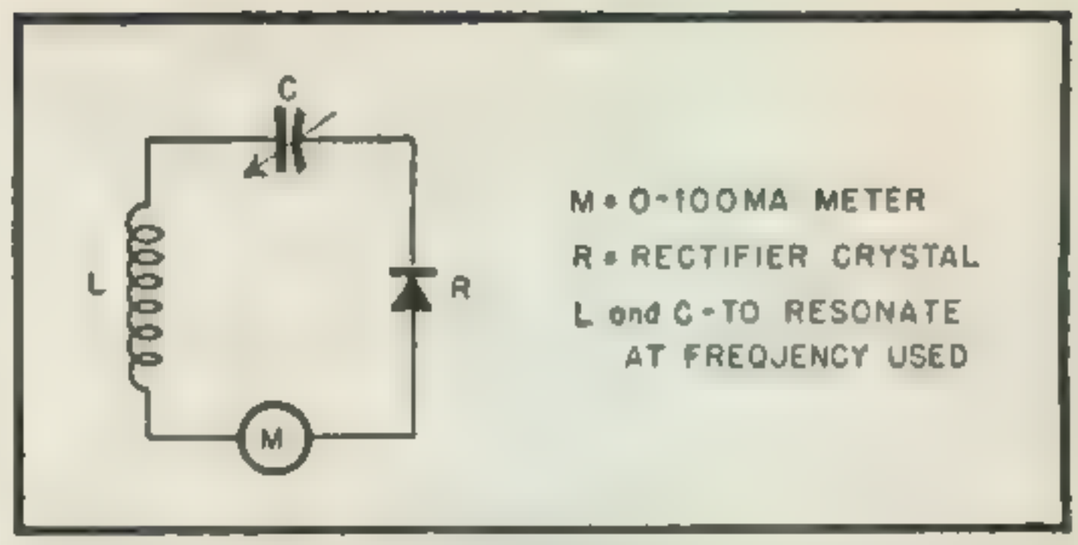


Fig. 6. Simple r-f current indicating meter used for field strength measurements

size wire and with the same spacing as the line. It is attached to the line at a point near the antenna end, as in *Fig. 5*. It is less than a quarter-wave in length and short-circuited at the far end, and its effect is that of an inductance variable in proportion to its length. When the stub is of the correct length and is connected at the correct point on the line, the inductance of the stub will neutralize the capacitance of the line at that point. The line will then become terminated with a resistive load matching the line impedance and standing waves will be eliminated up to the point where the stub is attached, existing only in the short length of line between the stub and the antenna.

Now, while the matching stub is such a simple thing to make, its correct length and the correct point of connection to the line are not quite so easy to determine. In the first place, these dimensions vary not only with frequency but also with the degree of mismatch between line and antenna. It is possible to get them right by trial and error and checking with a field-strength meter or a meter to measure current in the antenna, but it is likely to be a long and tedious process. There is a much easier way whereby all measurements are made at the transmitter end of the line—usually in the operating room.

First, make an r-f current meter, *Fig. 6*. The components should be rigidly mounted on a piece of bakelite, and the assembly arranged to fasten to the transmission line so that the coupling between coil *L* and the line will not vary.

Test Procedure

Temporarily short-circuit the line at the antenna end. Returning to the transmitter end of the line, locate with the meter a point of minimum current. The minimum point may be rather broad and difficult to determine exactly. In this case locate points of equal current on either side of the minimum. Half way between these will be the minimum point. Mark the line at this point. Now remove the temporary short-circuit and repeat the minimum current point locating procedure until you have found a new minimum point which is within a quarter-wavelength of the first point. If you go beyond a quarter-wavelength you are moving in the wrong direction—return to the first minimum point and continue in that direction. When you have correctly located the new point (1) note the meter reading and (2) measure accurately the distance between the old and the new points. Now continue along the line in either direction and locate a point of maximum current. You can check this point against the frequency as the maximum and minimum points will be a quarter-wavelength apart. Note the meter reading (3).

Using Lecher Wire

Perhaps your transmission line is so located that you can't readily get at it to make these measurements—then build yourself a Lecher wire. You should have one anyway to make accurate frequency measurements. Use the same

[*Continued on page 58*]

TABLE 2

Ratio Max/Min	52 mc.		146 mc.		222.5 mc.	
Current	L	D	L	D	L	D
1.5	41	31-3/8	14-5/8	11-1/8	9-19/32	7-11/32
2	33	33-1/2	11-13/16	11-15/16	7-3/4	7-27/32
3	25-1/4	36-7/8	9	13-1/8	5-29/32	8-5/8
4	21	39-3/8	7-1/2	14	4-29/32	9-7/32
5	17-7/8	40-1/2	6-3/8	14-7/16	4-7/32	9-1/2
6	15-7/8	41-1/2	5-5/8	14-3/4	3-23/32	9-23/32
7	14-3/4	42	5-1/4	14-15/16	3-15/32	9-13/16
8	13-1/2	43-1/4	4-13/16	15-3/8	3-5/32	10-1/8
9	12-3/4	44	4-9/16	15-5/8	3	10-5/16
10	11-3/4	44-1/2	4-3/16	15-7/8	2-3/4	10-17/32

Medium Power Phone Transmitter

FRANK C. JONES, W6AJF*

THE PLATE-MODULATED transmitter illustrated here has several interesting circuit ideas built into it, such as a means of electrically shifting the crystal-controlled frequency over a range of as much as 10 kc to 15 kc in the ten-meter band. The class B modulator is driven by a power-tube type of cathode follower which is considerably different from the more conventional method of using a pair of type 45 triodes. Bands covered are 3.5, 7, 14, and 28 mc.

The crystal oscillator uses a type 7C5 or 6V6GT tetrode functioning as an oscillator-amplifier or oscillator doubler. Basically the circuit is the familiar "harmonic oscillator" in which the tube and external capacities act as a Colpitts oscillator with the crystal serving as a high-Q tuned circuit. The plate circuit can be tuned to the crystal fundamental frequency or to any harmonic. Proper choice of grid-leak value and screen grid voltage permits obtaining about the same output on the fundamental or the second harmonic. Tuning to the third harmonic of the crystal will produce roughly half as much output as on the second harmonic. Likewise, the fourth harmonic will be about half as strong as the third or one-fourth as great as the second.

Shifting Frequency

The standard harmonic oscillator can be easily modified by including an inductance and capacitance in series with the crystal to vary the net reactance of the crystal itself over a limited range. This particular type of oscillator permits greater frequency shift in this manner than can be obtained with most other crystal oscillators. There is a certain critical inductance for each crystal, but fortunately a variable condenser in series with the coil can be used effectively to vary the net reactance of the whole circuit. A small variometer makes an ideal inductance; however, a tapped coil of 40 or 50 microhenrys does a fair job. The condenser can be small—250 $\mu\mu$f maximum capacity. In this transmitter, the coil switch has one position in which the whole coil is shorted out. A corner of one stator plate in the condenser was bent over sharply so as to act as a short circuit when the condenser plates are fully enmeshed. With the coil and condenser shorted, the oscillator functions at the normal frequency of the crystal.

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Some 3.5 mc crystals, tested by the writer, permitted as much as 5 to 10 kc shift on the fundamental frequency which would mean 20 to 40 kc change in the 14 mc amateur band. All active crystals in this range gave changes of at least 2 kc without any apparent loss of "crystal control" keying stability on c.w. Seven mc crystals could not be changed as much in most cases, but the net frequency change in the 28 mc band was enough to dodge some QRM areas.

The grid-to-cathode feedback condenser in the 7C5 oscillator was made variable. A fair rule-of-thumb value for this condenser is 10% of the value of the condenser connected between cathode and ground, in this case 25 $\mu\mu$f in the feedback condenser and 250 in the cathode bypass condenser. Twenty $\mu\mu$f and 200 $\mu\mu$f are excellent values for use with 7C5 or 6V6GT tubes in a harmonic oscillator. The cathode connects through a 2 or 2½ millihenry small r-f choke and 200 or 300 ohm resistor to ground or meter circuit.

An 807 screen-grid tube was chosen for a buffer or doubler stage with a high value of grid-leak in order to obtain lower output as a buffer amplifier and high output as a frequency doubler. Since the 4E27 final amplifier is quite easy to drive, an 807 can be used with a plate supply voltage of from 250 to 300 volts. An 807 does not require neutralization as an amplifier, so was chosen in preference to a 7C5, 6V6 or 6L6, any of which would supply enough drive to the 4E27 but would require neutralization.

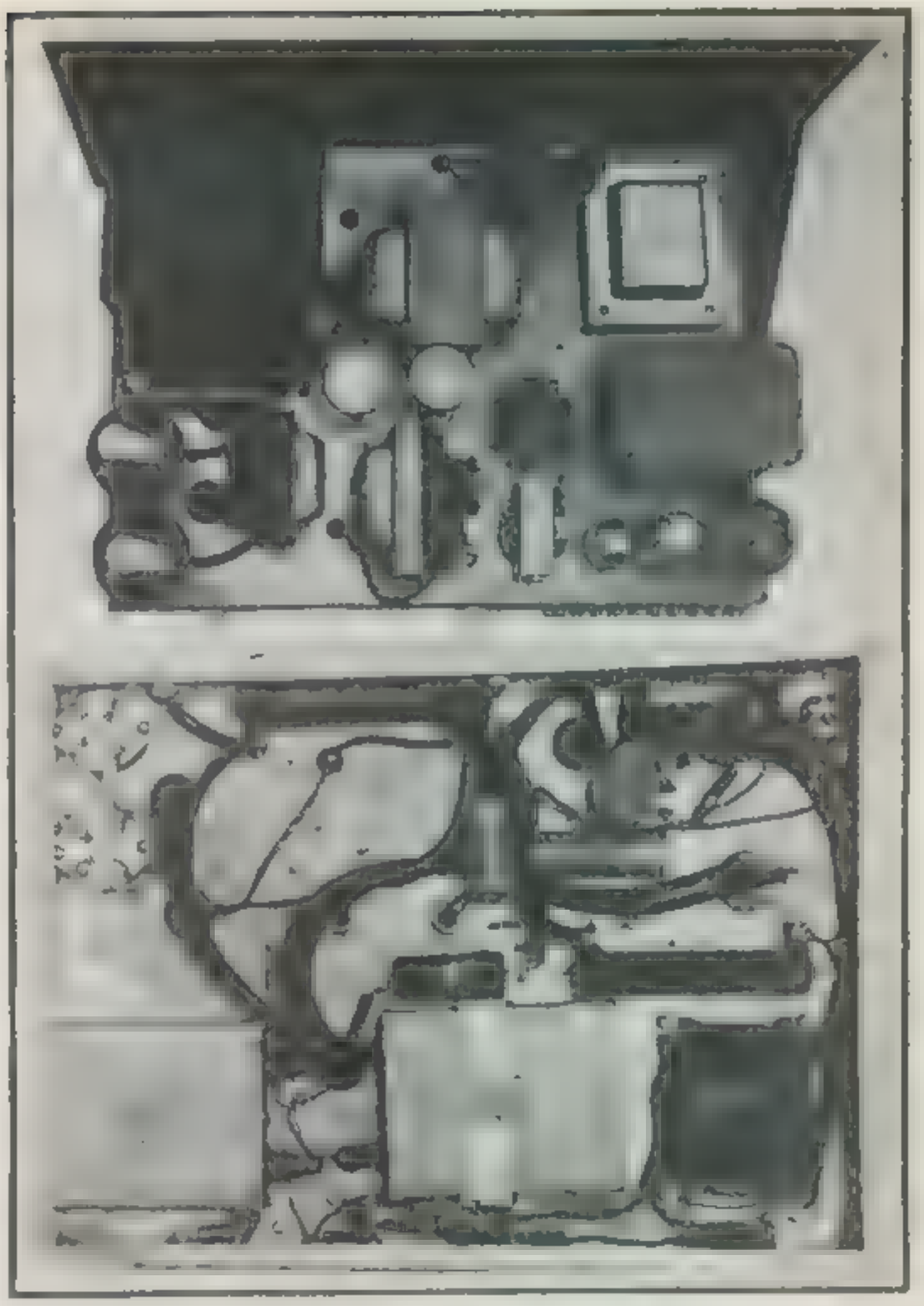
Coupling Method

In setting up the circuit between the 807 and 4E27 tube, capacity coupling was used at first. Trouble with ground returns of the 807 and 4E27 tubes reduced the grid current in the ten-meter band to a low value. Unity coupling with a tuned plate coil and an interwound secondary 4E27 grid coil of the same number of turns, remedied this situation and was built into the set for use on all bands. The 4E27 tube has a conservative plate dissipation rating of 75 watts and has short leads and low inter-electrode capacities. The output on the higher frequency bands is quite high as a result, and two 100 watt lamps as a dummy antenna lit up to about the same brilliancy as a 100 watt lamp on the 115 volt circuit.

In common with most screen-grid tubes, modulation must be applied to the screen grid as well as the plate which means a large screen-dropping resistor from the modulated high-voltage source. This works fine for phone operation but is not very good for c.w. since the screen voltage rises to the full plate voltage value when the key is open. Center-tap keying (with a short circuit across the plate modulation transformer secondary) can be used for c.w. The most satisfactory method of c-w operation is to use a separate low-voltage supply, since the fixed bias on the input grid can then be of a reasonable value and oscillator or buffer stage keying can be used. The difficulty is to obtain a few hundred volts of audio on the screen for phone operation when using a separate screen supply.

Bias Supply

A simple form of fixed C bias supply was built into this set using a shunt type voltage-doubler rectifier with a 6H6 tube to "keep alive" a neon bulb regulator. A 1-watt neon bulb needs about 1 ma to keep ionized and the final grid current of from 1 to 3 ma then adds to this value without appreciably changing the C bias voltage. Higher C bias can be obtained by using 1-watt neon

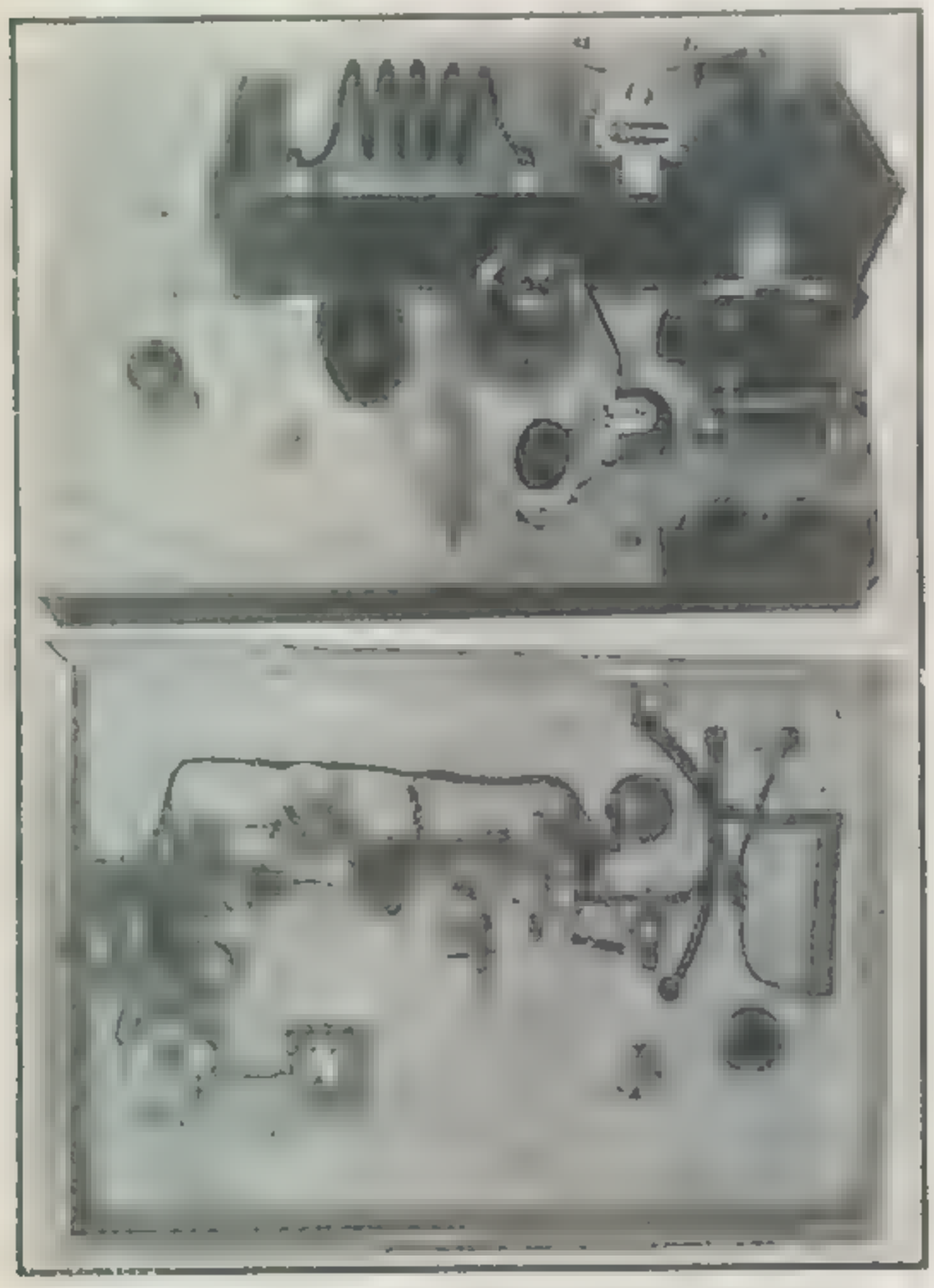


Power supply for both r.f. and a.f. units is mounted on bottom chassis

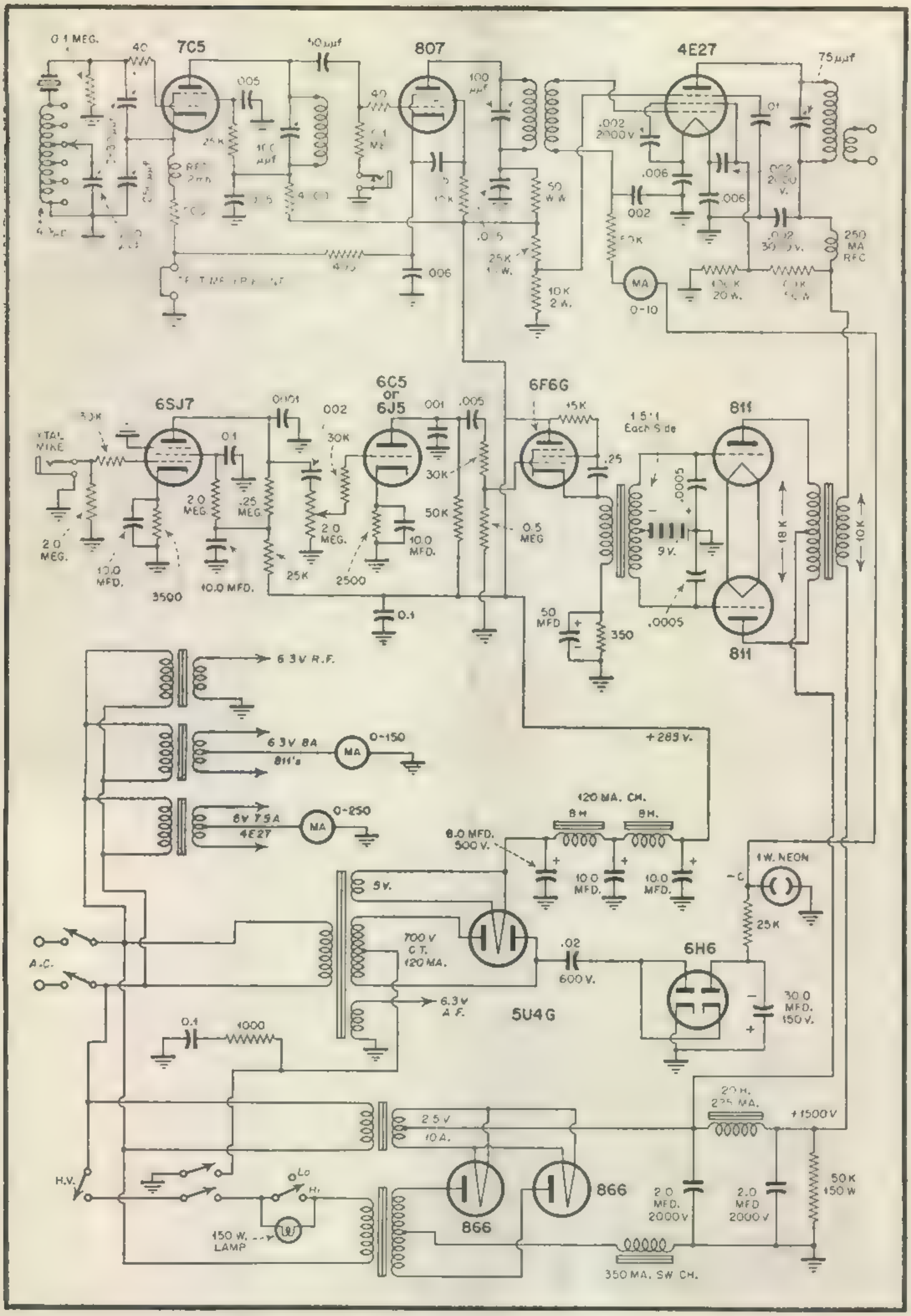
bulbs in series figuring about 65 volts per tube. The bayonet-type based neon bulbs have no series resistor and so should be used for this purpose. The neon bulbs with a screw type base have built-in resistors which makes them unsuitable for this service. The shunt type rectifier uses a .02 μf 1600 volt paper condenser as a voltage reducer from one side of the low voltage transformer. This value is suitable for use with one neon bulb. Two or three in series might require an .04 or .05 condenser, which must be able to stand over 300 volts of 60-cycle a.c. across it. The capacity must be small enough to limit the current (by reactance drop) through it and the 6H6 to less than 8 or 10 ma. Fortunately for other applications, this enables using a 6H6 rectifier to energize a larger regulator tube such as a VR105 or VR150, which require at least 5 ma of "keep alive" current.

The audio system uses a standard class B modulator with a pair of 811 tubes. In order to save space and because of present scarcity of power supply components, one high voltage system was used for both r-f and a-f amplifiers. The 811 tubes can be used with zero bias with plate voltages of 1000 or 1250 but require a small C bias for 1500. Two 4½-volt C batteries were connected in series to provide a 9-volt bias.

Due to the compact arrangement of parts,



Unconventional in amateur design, the r-f chassis is mounted vertically, flush against the front panel. The bottom-plate ledge is used to hold the fastening bolts. Wiring is straightforward and simple. Note crystal socket which faces front panel and is accessible through a panel opening

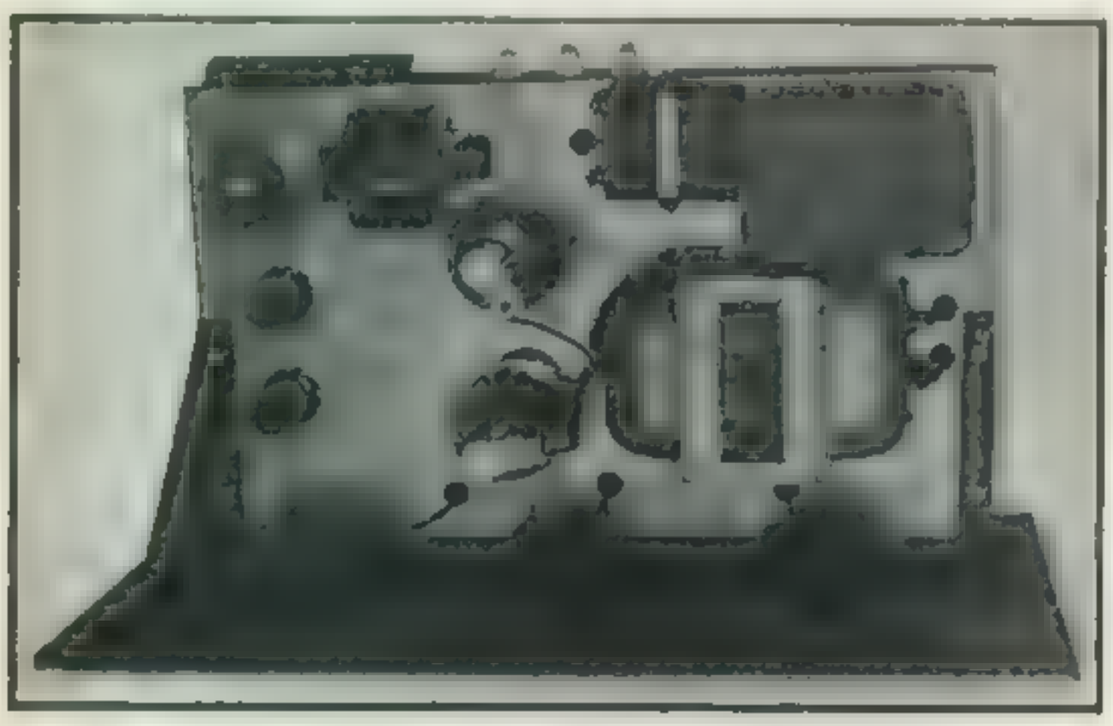


Circuit diagram of complete medium power phone transmitter. Power input is approximately 225 watts on all bands

some trouble was encountered in the 10-meter band with r-f feedback into the audio system. To overcome this, small 30,000 ohm resistors were wired in series with the grid lead of each speech amplifier stage and small mica condensers were connected from plate to ground in the first two stages.

The Driver Stage

The Class B driver stage is of a design offering worthwhile advantages over the usual push-pull triode stage. A power tetrode or pentode is used as a cathode follower driver for the 811 tubes, offering a generator or driver source of very low impedance as compared with even a 2A3 triode. In this particular transmitter, the plate and screen of the modulated stage run about 230 watts d-c input. For complete modulation, the peak a-f power must be equal to this, requiring an average power of 115 watts of sine wave audio or about 60 or 70 watts of speech power. The peak power must not exceed 230 watts, which corresponds to 100% modulation. The peak power of the 811 tubes is equal to $(E_{max}—E_{min})$ I_{max}. This indicates a peak plate current of 180 ma per tube and a plate-to-plate load of about 30,000 ohms. The modulation transformer available could step the 10,000 ohm load up to 18,000 ohms, so that combination was used. According to the 811 tube data curves, the 811 tubes should be driven to a positive peak voltage of nearly 45 volts and a peak current of about 30 ma, or a peak grid driving power of less than 1½ watts. This can be easily obtained from a cathode follower driver. With a 1½-to-1 ratio of primary to each side of the secondary in a standard small class B input transformer, the load impedance will be about 3000 ohms for this example, and since the cathode follower has an internal impedance of from 200 to 400 ohms (depending upon the choice of tube types and plate current) the tube will look into a relatively high load impedance and have a gain of nearly .9 Using these figures, the peak voltage needed on the 6F6 driver grid is about 75 volts, a value which can be obtained from a 6C5 or 6J5 resistance-coupled stage.



Speech amplifier and 811 modulators are mounted on one chassis

4E27 TRANSMITTER COIL DATA

Final Plate coils on 2" diameter ceramic, except 28-mc coil forms.

3.5 mc band—31 turns #14E 12 turns per inch
7 mc band—15 turns #12E 10 turns per inch
14 mc band—10 turns #12E 5 turns per inch
} Ceramic forms.

28 mc band— 5 turns of ¼" dia. tubing, 2" dia. 4" long.

807 & 7C5 COILS INTERCHANGEABLE

3.5 mc band: 25 turns, #22 DCC. 1½" dia. 1¼" long primary, 30 turns, #26 DSC. at lower end of primary

7 mc band: 16 turns, #20 DCC. primary 1½" dia. 1¼" long; 16 turns, #22 DCC. secondary interwound

14 mc band: 8 turns, #20 DCC. primary 1½" dia. 1¼" long, 8 turns, #22 DCC. secondary interwound

28 mc band: 4 turns #18 primary 1½" dia. 1" long. 4 turns, #22 DCC. secondary interwound

Plate and grid leads out top ends of windings.

Crystal Oscillator coil—50 turns #26 DSC. 1" long, 1" dia., with taps every 10 turns.

Modifications

Where this general system is used with a larger final amplifier requiring 400 or 500 watts peak audio power and the 811 tubes are worked at more nearly their usual output values, a larger step-down ratio in the driver transformer would be needed. Using high power the grid impedance per tube would be more nearly 1000 ohms instead of the 1500 ohms in the above example, and more peak grid driving power is needed. A 6L6 tetrode cathode follower with a 3-to-1 step-up interstage transformer from the 6J5 stage and perhaps a 2-to-1 or 2½-to-1 step-down Class B driver transformer would be satisfactory. In designing Class B modulators, it should be remembered that high d-c plate voltage reduces the maximum value of required peak plate current and peak grid driving voltage and current. In the first example shown above, a pair of 811 tubes supplying 230 watts peak output requires very little more driving power than a 6A6 or 6N7 Class B stage supplying 25 watts of peak power output.

High-Frequency Propagation

E. H. CONKLIN, Comdr., USNR, W3JUX*.

New hams who want to work DX and old hands who are interested in improving their results will find this review of high frequency propagation paying dividends in increased operating pleasure

MANY OF THE fundamentals in high frequency propagation are only matters of slight or of vague importance to the 40-20-13 or 10 meter Ham. While DX-ing we actually employ their effects in one way or another, but there are few among us who can rightfully claim a working knowledge of the techniques of high frequency communication. The data obtained in the field by our Armed Services during war is now serving to clear up many of the hazy spots in our pre-war thoughts and should enable everyone to better understand the why and wherefores of short-wave communication.

Why the High Frequencies?

When we refer to the low frequencies it is the practice to consider, in one broad sweep, those frequencies on the long wave side of the standard broadcast band. These waves generally travel outward with gradually decreasing signal strength at increasing distances. Considerable power is therefore necessary to reach long distances, and antennas must be large to radiate any degree of power efficiently. For many applications, it is desirable to use high frequencies for the following reasons:

(a) Communication requires less power at long ranges.

(b) The antenna may be smaller, permitting the erection of high gain directive arrays.

(c) Many more channels are available in the high-frequency part of the spectrum than are contained in the low-frequency range.

(d) Static and atmospheric interference is considerably reduced at increasing frequencies,

*Conklin Radio Co., 6800 Clarendon Road, Bethesda, 14, Maryland

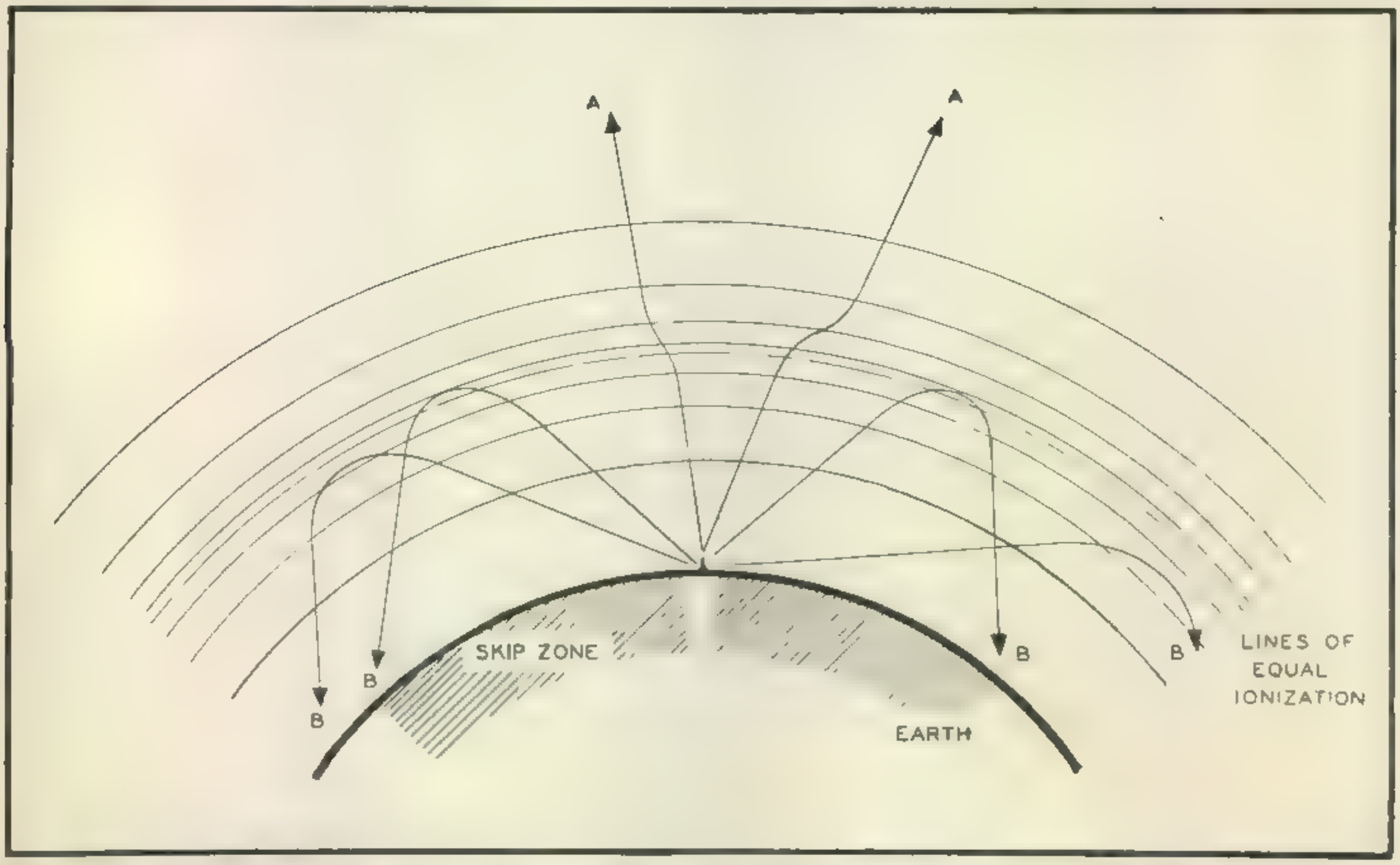


Fig. 1. Simplified view of ionosphere layer which reflects low-angle signals back to earth, while high-angle signals continue out through space. Note silent or "skip" zone resulting from lack of signal reflection in that area

'till at the border of ultra-high frequency range it is negligible.

Of course, the above advantages are obtained only by accepting an amount of uncertainty as to the proper frequency which will reach a given point at a certain time, which is complicated by the fact that conditions occasionally are far below normal, due to ionospheric or magnetic storms.

Communication Beyond the Ground-Wave

The "ground-wave" range at high frequencies depends upon power, but is of the order of twenty to thirty miles. Distances beyond that are reached by signals leaving the antenna at medium or low acute angles to the horizontal, and being reflected from one of the ionized layers located somewhere between 60 and 200 miles above the earth. If the frequency is too high, it will not undergo refraction or reflection, but will pass through the layers and not be returned to earth where it may be heard again.

This situation is pictured in *Fig. 1*. Signals leaving the transmitter toward points marked *A* pass through the layer into inter-stellar space. Those striking the layer with a more glancing blow at points marked *B* are returned downward and can again be heard at some distance from the transmitter.

A radio signal radiated at a low angle will be reflected easier than a high angle one. Therefore, for a given frequency, there may be a distance beyond the ground wave range called the "skip zone," in which the signals are not heard. Generally, if the power is sufficient, a great number of individual angles of reflection will occur to completely fill in the second or third skip zones.

This is somewhat of an over-simplification, since many signals are frequently heard within the skip zone by scattered reflections. An example of this might be amateur 28 mc communication between stations a few hundred miles apart on the east coast, when beam antennas are pointed southeast in the forenoon. Similar conditions are often found on the west coast when antennas are directed to the southwest in the late afternoon.

The Sunspot Cycle

When speaking of long-range radio transmission, it must be remembered that all high-frequency radio conditions are influenced by the effects of a long term sunspot cycle of about eleven years. The last minimum of the present cycle was in 1944, as shown in *Fig. 2*. At the bottom of the cycle, medium high frequencies must be used in order to be refracted by the ionosphere. At the peaks of the sunspot cycles, the high and very-high frequencies become useful. This fluctuation may be as much as five-to-

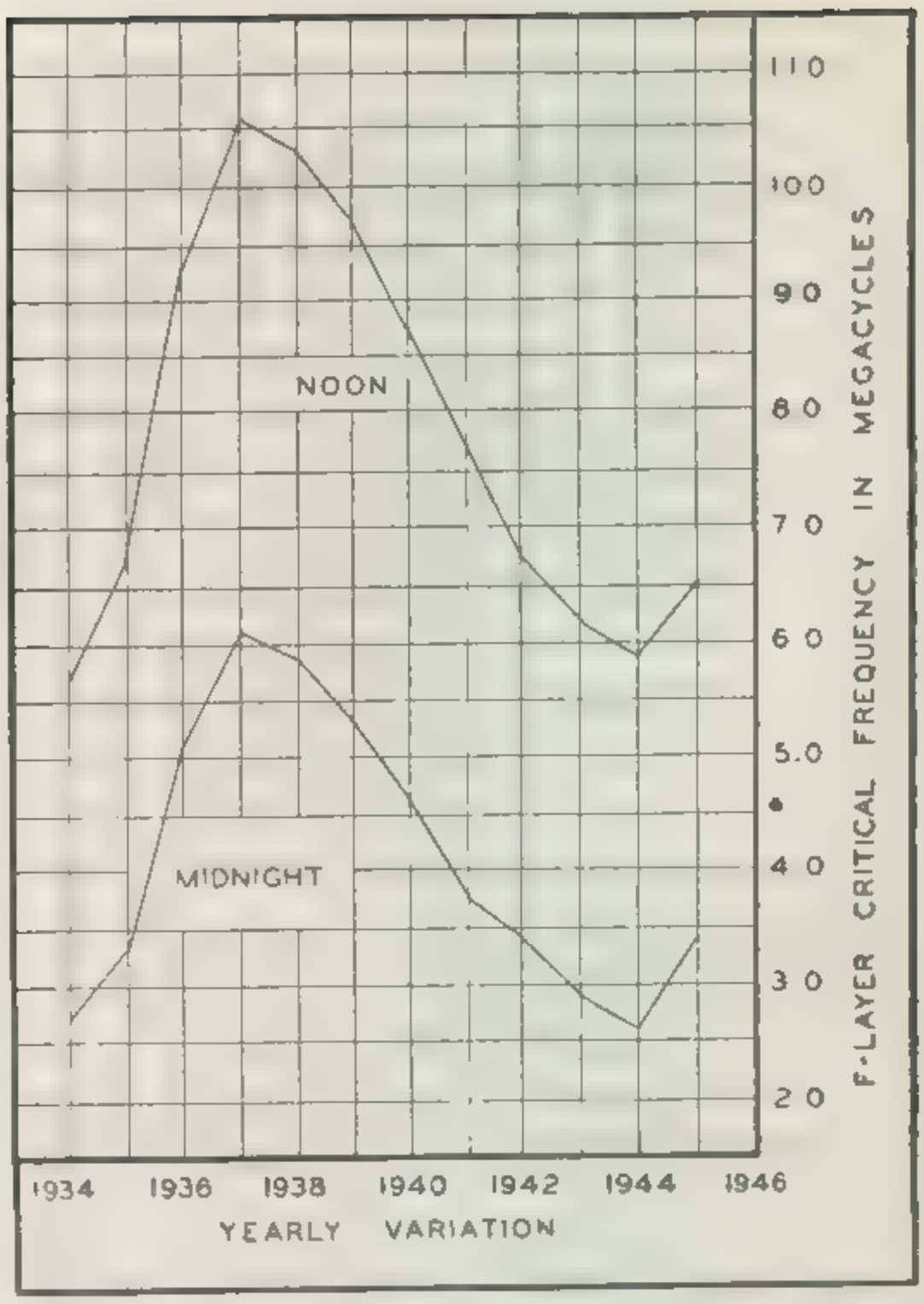


Fig. 2. The sunspot cycle, illustrated by yearly averages of the F-layer critical frequency in megacycles, for noon and midnight at Washington, D. C., for the last 12 years.

one in the maximum radio frequency that can be used. On any single day the highest frequency useful for long-range communication is reached in the early afternoon.

The diurnal change in the highest usable frequencies, for a day near the sunspot minimum, is illustrated by *Fig. 4*. Similar data is given by *Fig. 3* for a day near the sunspot maximum. Even higher frequencies can often be used for short periods, but these are complicated when strong sporadic E layer reflections are present. These reflections are the outstanding cause of most amateur 50 mc communication at 500 to 1000 miles, and the effect of "short skip" on 28 and 14 mc.

Absorption

While it would at first appear that at sunspot maximum (*Fig. 3*) a greater number of frequencies are available for use, we will find that another factor, that of absorption has entered the picture. Although ionospheric absorption of radio energy is principally a daylight phenomenon, this situation results in a requirement for prohibitive amounts of power to maintain communication in daytime unless the transmissions are shifted from the medium night time frequencies to much higher daytime frequencies. The cross-hatched areas in *Figs. 3* and *4* include frequencies

and times when this effect is true. Low power amateur transmissions and many of the new radio-mechanical forms of communication, such as radioteletype, being critical as to the amount of power available, must rely upon a careful selection and a more frequent shifting of frequencies.

It will be noted that conditions which permit the use of the same long-distance frequency for several days are the result of conditions at the bottom of the sunspot cycle, especially in the summer months. At the present time and for the next several years, during the period of increasing sunspot numbers, long-distance circuits will generally have to be shifted to higher frequencies in daylight hours to avoid loss of communications due to weak signals. Of course, communication cannot be maintained at night on the daylight frequencies because the latter will not be reflected back to earth. It will be seen from these general indications that only a relatively narrow band of frequencies is useful for any given direction, distance and time or day.

When to Use a High Frequency

The need to select the proper frequency is illustrated by a situation which occurred on board the USS *Lake Champlain* in the North Atlantic Ocean last December. The ship upon calling Radio Washington (NSS) on 16,970 kc was told that its signals were good. At that particular time the 10 meter amateur band was open and signals around 29 mc were being received. Washington, however, instructed the ship to use a radioteletype circuit on a frequency of about 4 mc., where the signals were found too weak for automatic methods.

A similar case is reported from the Naval Operating Base in Rio de Janeiro, where the primary fleet broadcasts were too weak to read in the daytime. This, it is presumed, is an indication that the period of the sunspot cycle is approaching when the Navy will be obligated to transmit these broadcasts on 20 mc or higher, in daytime.

In many instances it will be found that stations are not heard simply because none is transmitting. This is especially true on the fall 10 meter band, where a blind CQ has often resulted in some unscheduled DX. An example of this was noted on the *Lake Champlain*. Since it is the practice to maintain early morning communi-

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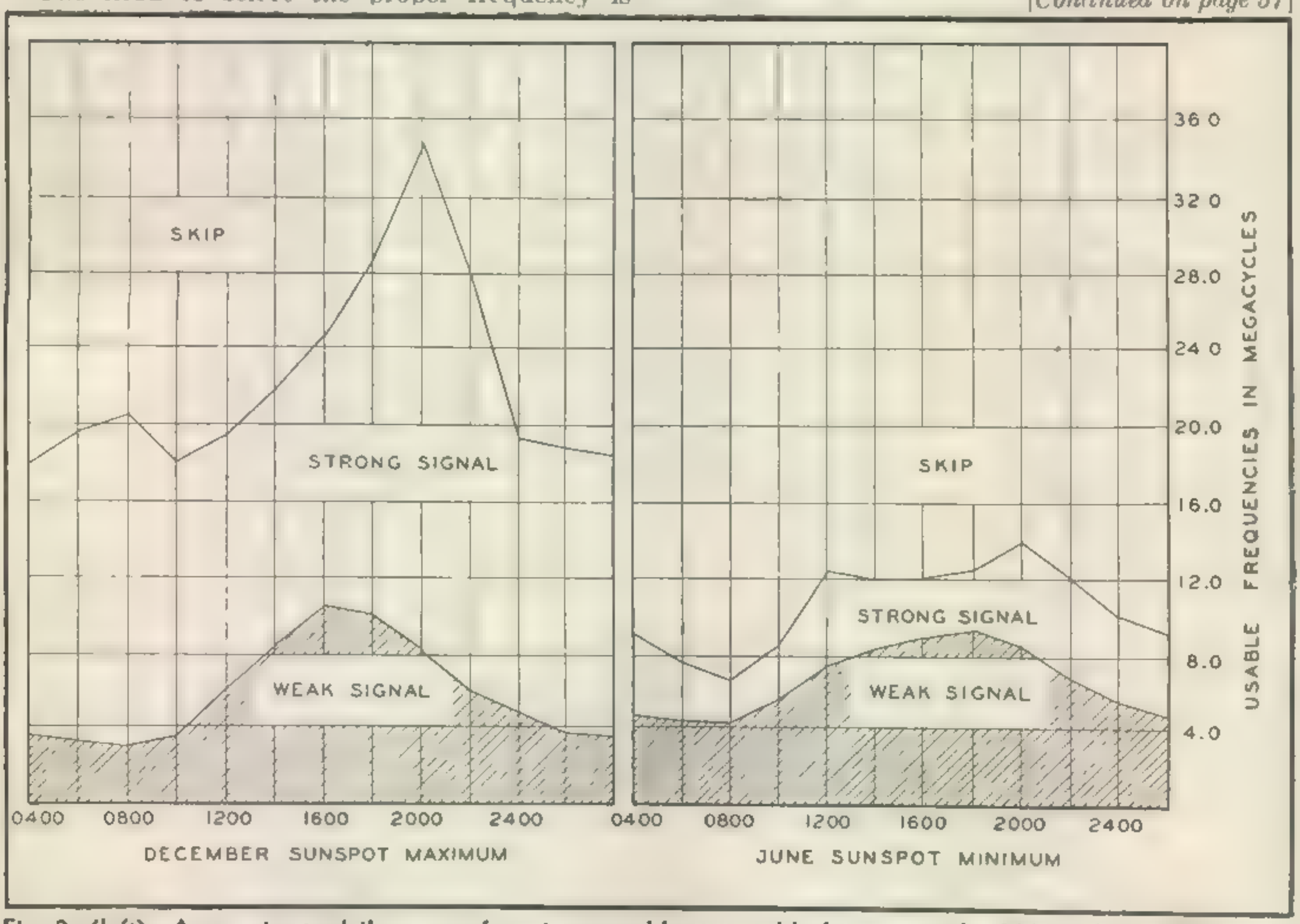


Fig. 3. (left). Approximate daily curve of maximum and lowest usable frequencies for 2000 mile work centered on Washington, D. C., for December at the top of the sunspot cycle. Weak signals result from attempts to use frequencies falling in the cross-hatched area. Frequencies above the upper line skip over the distant point. Usable frequencies, therefore, are between the two curves. Fig. 4 (right). Approximate daily curve of maximum and lowest usable frequencies for 2000 mile work centered on Washington, D. C., for June at the bottom of the sunspot cycle. Weak signals result from attempts to use frequencies falling in the cross-hatched area. Frequencies above the upper line skip over the distant point. Usable frequencies, therefore, are between the two curves

Monthly DX Predictions---AUGUST

OLIVER PERRY FERRELL

Comments and Problems

Comments from the users of the Band Predictions are invited and are of interest to CQ and to the IRPL. If you have some transmission problem directly involving conditions for DX-ing or want to know what would be the best average hours for working a certain city from your location you are invited to write to the Propagation Editor, CQ Magazine, 342 Madison Ave., New York 17, N. Y. Please enclose either a penny postal or a stamped self-addressed envelope for reply. Allow 7 to 10 days for reply.

Radio Propagation Forecast

Radio conditions for the latter part of July and the first two weeks in August will be spotty with ionospheric disturbances predicted for the following dates:

July 15 to 18 July 26 to 27 Aug. 3 to 4

Currently observed data also indicates that predicted conditions of MUF will be somewhat greater than pictured in the July issue of CQ. Especially in the temperate zone after 1800 hours local time.

Specific ionospheric storm warning are broadcast by the North American Service of the B.B.C. and by WWV, National Bureau of Standards, Washington, D. C. The latter is transmitting continuously on 5, 10 and 15 mc. A series of "w"s signifies that conditions are below normal. A series of "n"s will signify that conditions are normal. These particular broadcasts are made at the 20 and 50 minute interval, after each hour.

USERS OF THE predictions charts will note a new shaded area on each graph this month. This area will be found occurring near local noon and will represent those frequencies which are absorbed in the ionosphere and cannot be employed for direct communication.

For example in *Fig. 4*, which is the predicted average day conditions from New York City to Paris, we can now obtain a considerably better picture of actual DX conditions. After the nightly low in MUF (maximum usable frequency), a rapid transition occurs between 0400 and 0600 hours EST. The 40 meter band which has been partially open all night will suddenly fade out in this direction after probably 0630 hours. Twenty meters will open for a short time, but generally conditions will be poor, especially between 1000 and 1200 hours. After 1400 hours, however, we may expect European signals both in the 13 meter and 20 meter bands to be good. The 13 meter opening will naturally be short, although fair conditions (top shaded areas) will be observed during most of the daylight hours. Best 20 meter conditions (widest separation of lower shaded areas and upper shaded areas) will occur around 1600, with the band closing somewheres after 2000 hours EST.

The plotting and prediction of absorption is somewhat more variable than predictions of MUF. Absorption is directly related to solar radiation, but does not follow a definite diurnal pattern and cannot be calculated with the accuracy of the MUF. Considerable variations will be noted from day to day since the degree of absorption will be relative to the transmitter and

[*Continued on page 38*]

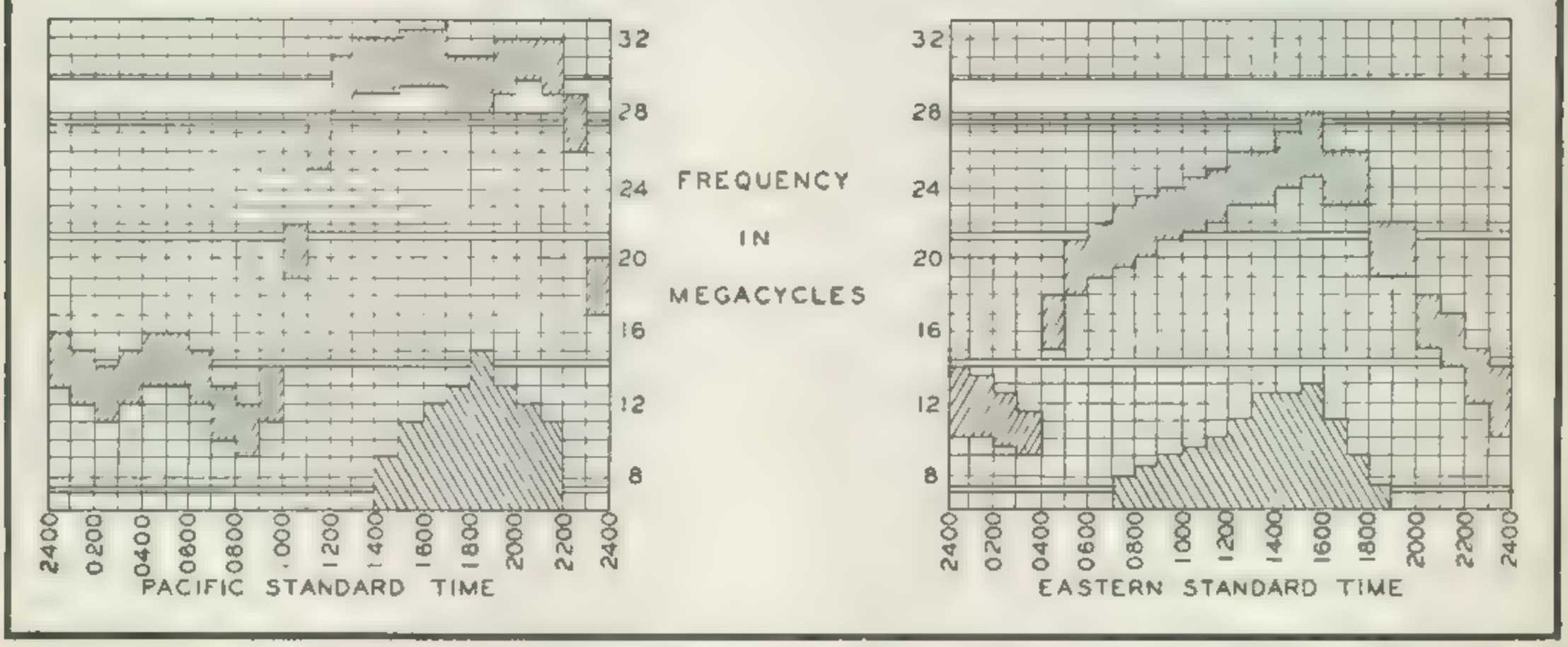


Fig. 1 (left). MUF San Francisco to Wellington, New Zealand. August 1946 average. Fig. 2 (right). MUF New York City to Leopoldville, Belgium Congo. August 1946 average

CQ DX

By HERB BECKER, W6QD

[Send all contributions to Herb Becker, 1406 South Grand Ave., Los Angeles, 15, Calif.]

WITH the 20-meter band just opened, as this is being written it's not necessary for me to tell you what bedlam stirs, which indicates you fellas have been planning on 20 and 40 for some time, otherwise, when the whistle blew for the bands to open, there could not have possibly been as many of the gang ready to go. Yes sir, you guys have really been doing something besides working 10 and 80 during the past couple of months. Several of the local boys, after trying to buck the traffic on 20 in the first few hours, phoned and said, "Herb, I'm only running a kilowatt and can't get to first base on 20, so I'm going back on 10 with the common people."

I don't think you fellows would really want the band completely deserted, however, and I feel sure that after some of the steam has given out, the band will restore itself to a partial semblance of the pre-war 20 meters. It is really unfortunate that the column deadline is today; here we are, chafing at the bit, to get some hot DX news, but we just can't seem to get anything definite being worked on 20. Judging from the way some of the stuff rolled in on my receiving box, I'd guess we'll have quite a bit to report next month.

Received a letter from our old DX pal, Charlie Miller, W8JSU. It's been five or six years since we had heard from Charlie, and at that time, you may recall, he was having his troubles. A flock of pigeons which his dad was training, just couldn't work up any respectable enthusiasm over Charlie's various antennae. Result: W8JSU off the air, and one pigeon casualty!

Here are a few highlights from Charlie's letter. Early in '42 the OW sent W8JSU to what he calls the "Muddled East." In South Africa, he met ZS6DY, Harbor Master at Durban. Charlie then traveled through YI, SU, Syria-Lebanon, Turkey, EP, and a flock of others. While over there Charlie married a French girl, and listen to this: She speaks five languages and can copy Morse at 25 wpm on the mill. Late in '44 Charlie and his wife were ganged up on by a flock of microbes, and apparently were very ill, as they were flown home as what he calls, "almost stretcher cases." They have a little girl, born in December '45. Charlie is now with RCA and living in Camden, and is doing the best he can to get on the air on our various bands. W8JSU had a 6L6 running on 3.5 mc and with this he has worked 25 states, as well as VO1Y/VO6, 3660 kc; VO4F, 3600; W8QEN/CT2 3800, FT3R 3750.

Charlie thinks I'm on the wrong track in stressing DX operation while trying to preach good v-f-o operating technique. He seems to think too many of the boys have the GTH attitude when working DX. Obviously, I can't quite agree with him, but you will always find a few fellows who have no respect for the other guy.

OK1AW, Alois Weirauch, looking for DX on the v.h.f's

W8DWV paid a surprise visit to W8JSU recently, during which he mentioned I was all wet on saying W8CRA had been living in Pittsburgh. The reason this was printed was that the information was given to us by some of the W8 gang, and who are we to question a W8? During a recent QSO Frank himself indicated he was *back* in Canonsburg, which makes us glad.

W8CXX is in Baltimore with Westinghouse.

Winding up Charlie's letter he indicates he is in for some good stiff local competition, but I know he will do his best to keep his call out of the cellar.

Another old-timer heard from is G6QX, Bob Jardine. After seeing the DX column in the May issue Bob decided to put in his two-bits worth. He has just recently unpacked some of his radio gear and finds that he lost a T55 and a rectifier tube, due to what Bob calls, the "metal slinging" of the D4 boys. His Bi-push came through the ordeal OK, and after climbing a couple of trees, Bob now has an antenna with which he hopes to work most of the old gang on this side again.

W6AM has worked XU1YK 14220 kc, located in North China. QTH is E. S. Maloney, Hdqtrs., First Marine Division, F.P.O., San Francisco. Don also worked W2JE 14160 kc, located on Okinawa—both of the above on phone.

From Ken Boord, Short-wave Editor of *Radio News*, we learn that the South African Amateurs had their 7 and 14 mc bands opened on June 30th. Ken received this information by cablegram from Henry Eksteen of Pretoria, South Africa.

W2BJ is complaining about making the folded dipoles function properly. He says the feeding drives his "wacky." At present, Ray is using a 3 element close-spaced array, a la Jones, and says it sure "perks." He feeds this antenna with a quarter wave, 52 ohm RG8U 64" long, and then into a 300 ohm twinax line. He says W2EIE is really working some nice DX. I wonder just what W2EIE is working for DX. Speaking of W2's, W2VY is now located in Davis, California, and probably very soon will have a W6 call. He is assistant engineer at NBC's World-Wide Short-Wave Station in Davis.

Another old-timer heard from is W8JAH, formerly of Detroit, and now located in St. Louis. I remember quite a ham session in Detroit a number of years back, at which time I had a chance to meet JAH, as well as a flock of the other boys.

If any of you boys worked W9JYF while he was operating 10 meter phone and c.w. in Tokyo, you can now send your cards to him as follows: Ken Young, W9JYF, Route 1, Woodstock, Ill.. Ken had 350 QSO's during the three months he was on the air in Tokyo. Nice going.

California has gained another DX'r, ex-W9CDT, and ex-W7ELX. He is now W6VBY and is located with ABC in San Francisco. VBY says of the ABC studio gang in San Francisco, "The two hams on the air are announcers, and so far, no engineers have their rigs fired up. The transmitter gang, however, is a little better represented.

W8BKP is still running low power and says he will go to a kilowatt as soon as he has worked 100 countries. His 76th and 77th countries were VP9F and W8WSY/KP6. You will recall, George uses a double bi-square for north-south and a single bi-square for the other two directions.

Herb Brier, W9EGQ, sends in a little info as follows. It seems through some misunderstanding, W2VL was given credit for having worked 83 countries. Says W3VL, "Taint so, because I have worked only 41." Incidentally, W2VL claims an assist for helping W2IOP, our esteemed editor, work a certain DX station. How about that, Larry?

W8ERA worked TG9RC 3615 kc on c.w. His QTH, Ralph Cozad, c/o Pan-American Airways, Guatemala City, Guatemala. Also worked F8AA 3630 kc, also c.w. W8ERA has just cranked up his kilowatt, so I presume we will be hearing more from him now that 20 and 40 are open.

As for W9EGQ, he is still waiting for a telephone pole to be delivered. Good luck, Herb.

Bill Conklin, W3JUX, is a little unhappy because the power company cut down the antenna that he planned on using for 7 and 14 mc. Bill says he has been shunt-feeding a 20 foot tree on 80 phone. I know a ham whose profession happens to be a Tree Surgeon, and I don't think he would believe this.

Another letter from OK1AW. We see he has had difficulty in getting copies of CQ, as well as a letter or two from yours truly. We do hope that he will get the magazine without waiting much longer.

W2OAA/J8 has been on the air since January '46, in Seoul, Korea. His first "W" was W6JUW on phone. This was followed by a c-w QSO, with a W7VY. Harry says he is the first J8 ever to operate on 10 meters and by far the most powerful ham station ever set up in Korea. W2OAA uses a rebuilt HT-4 Transmitter, with a kilowatt input. The antenna is a 2 element rotary beam. The shack was in an SCR399 shelter, mounted on a 2½ ton truck. Harry has worked 52 countries. He hopes to be back home in New Rochelle, New York, around the latter part of August.

A card from SV1GR, who is president of the Hellenic Radio Amateur League of Athens, Greece, informs us that their league originated in '40, and is now in action again. Members would like all QSL cards sent through their HRAL Bureau as follows: Hellenic Radio Amateur League Q.S.L. Bureau. S. E. Stephanou (SV1GR). 14 Alkamnos Street, Athens-Greece.

The following is lifted from the Bulletin of the Society of Amateur Radio Operators, which is in the S. F. Bay area. Yes, I received permission. *"For Rent:* 6 room house situated in Oakland on top of a high hill. One block to transportation, shopping center and high school. Has two tile baths. Two car garage. Room built above garage about 10 x 15 feet. Through oversight this room wired with 6 wall plugs with #6 wire. PGE made mistake and left a 60' telephone pole in the backyard all set up. All telephone and light wires for ten square blocks are underground and everyone living within a radius of 25 blocks has a tuned r-f broadcast receiver with two stages r.f. and entirely shielded cabinets. Rent includes all gardener services and water—On a ten year lease $27.50 per month. . . . "Eh what, dear? . . . Wake up? . . . Oh I was just dreaming. . . ."

Ah, another W9 heard from, and it's about time. W9RBI of Madison, Wisconsin. I haven't heard from Herb Ross for years. Herb is now working at WIBA in Madison. He is using a T40 in his rig, with 150 watts input. He has worked 35 countries, most of them on phone. 9RBI has worked 113 countries pre-war, and has 110 confirmed. However, he is willing to start all over on a post-war basis.

Our friend, W7IDF, kicks through with a little interesting information about CE1AO, Harry Brumelle. Harry moved to Chile about 25 years ago, and has done his share of DX. Part of the success of CE1AO lies in the fact that he is close to the ocean for one thing, and the cliffs form a natural parabola, giving him the extra lift of reflectors. W7IDF has visited CE1AO and says he is extremely hospitable to visiting hams, and is unfailingly considerate in the use of the v.f.o.

W2IOP was on 20 the opening day, but says he is not working out too well as yet, mostly due to his antenna situation. Larry informs us W2GWE snagged VS4JH and EP1C on the first day. W6ENV and W6CEM also worked VS4JH. Larry says his first QSO on 20 was W6EBG and his first DX contact was VK2ACX. He has eked out a WAC so results are improving.

A letter from W6EAK, an old-timer out this way, gives a little information which some of you boys may like to hear. Prior to the war Court worked at the Control Tower at the Burbank Airport. Then he went into the Navy for four years, being discharged as a Lt. Commander in January of this year. The rig that he is now using has a pair of 250 TH's in the

[*Continued on page 55*]

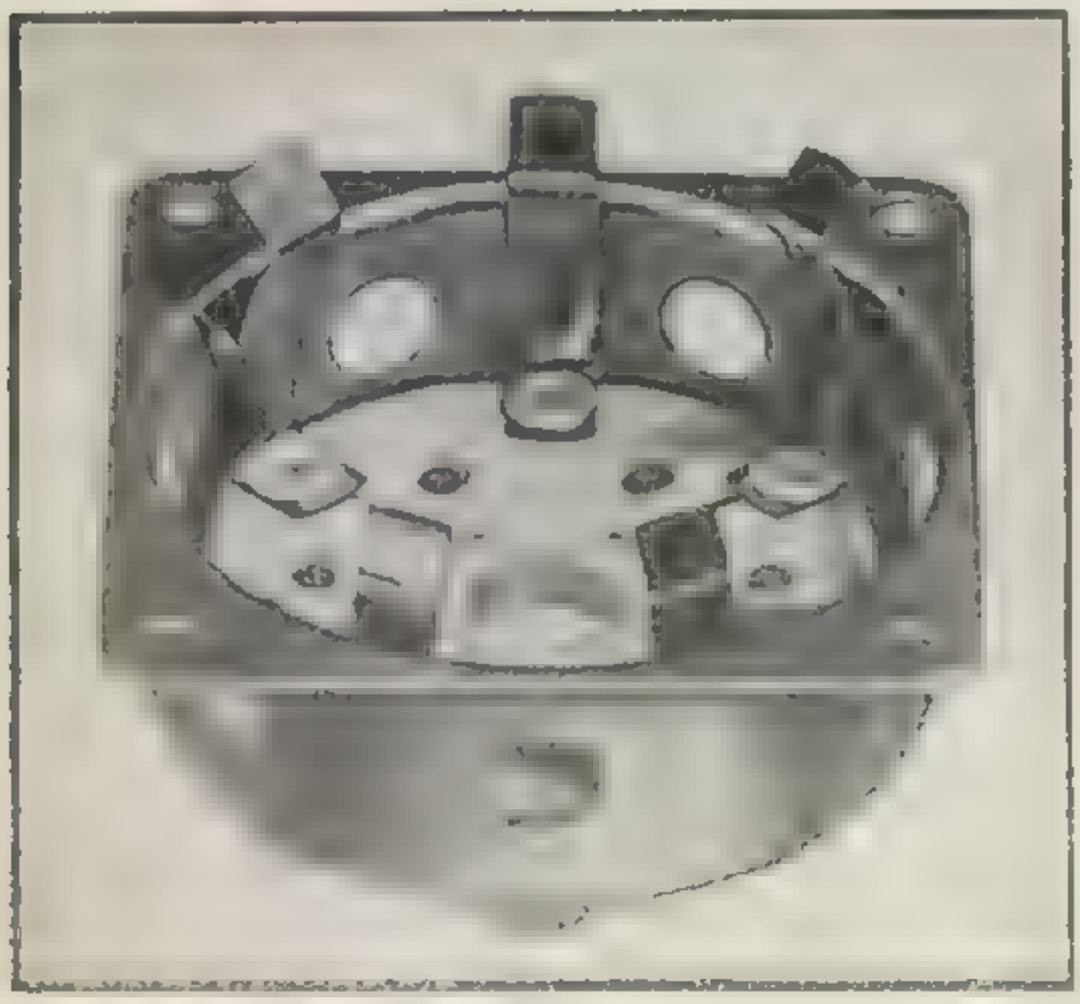
parts & products

Communications Receiver

The Cardwell Fifty-Four, a communications receiver incorporating many unusual features has been announced by the Allen D. Cardwell Manufacturing Corp., Plainville, Conn. Among the outstanding points of this new receiver are: full turret r.f. section, frequency coverage to 54.0 mc. built-in secondary frequency standard, direct reading liner type dials, all miniature tubes, threshold squelch, temperature compensated oscillator, and a new type noise limiter. Full technical details may be obtained by writing to Cardwell.

Transmitting Tube Socket

The E. F. Johnson Company, Waseca, Minnesota announces the latest addition to their line of tube sockets, the Johnson 122-101. This socket is designed especially for 826, 829 and 832 transmitting tubes. The Johnson 122-101 is a ceramic



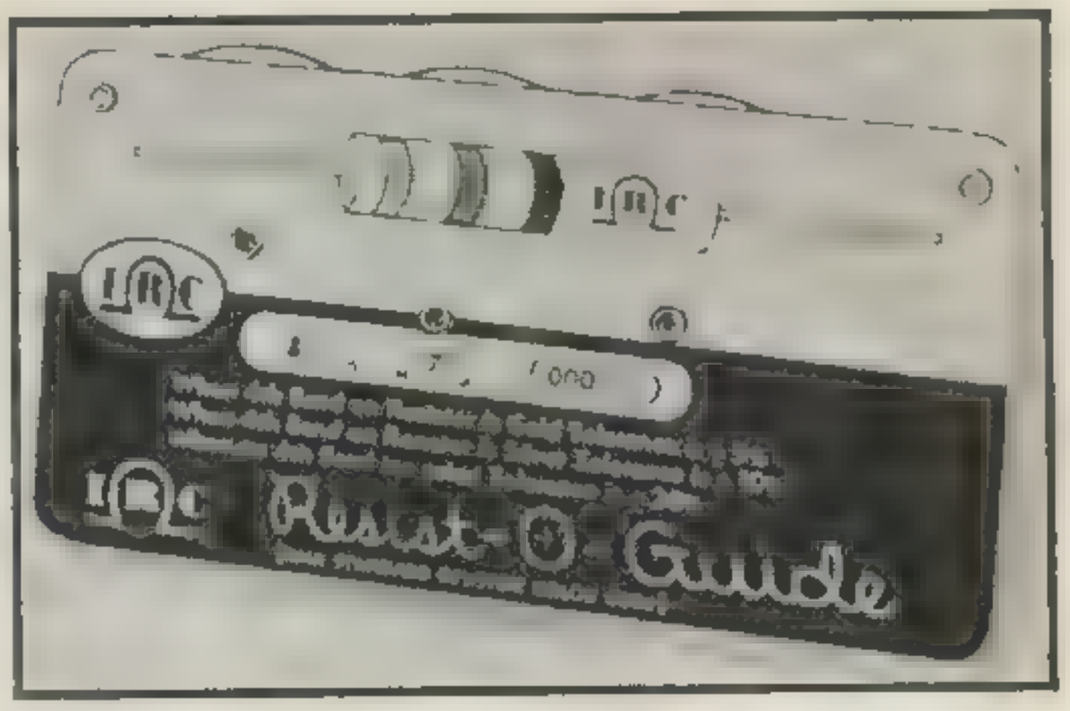
socket with an aluminum base shield, and is designed so that button mica by-pass capacitors may be mounted directly on the tube socket base, thus enabling the tube to be used at its highest frequency.

Other features include grid terminals designed so that the connecting wires may be isolated from other circuits and especially constructed to permit small grid coils to be mounted directly on the terminal ends, thus eliminating connecting leads. Provision has been made for adequate ventilation of the tube. Built-in retainer springs hold tube securely in place under conditions of heavy vibration and shock.

Resistor Guide

International Resistance Company, Philadelphia resistor manufacturer, announces the Resist-O-Guide — a practical aid in resistor range identification.

The pocket size Resist-O-Guide is used by turning its three wheels to correspond with the color code on any composition type resistor — the standard



RMA range is automatically and accurately indicated. Or turn the wheels to indicate any desired standard range, and you are immediately shown the correct color coding. The Resist-O-Guide is available at IRC distributors.

R.F. Chokes

Two new chokes, the R-100S in the 2½ mh size and the R-300S in the 1 mh size, have been placed on the market by the National Company, Inc. of Malden, Mass.

The R-100S is a continuous universal winding in four sections wound on an isolantite form for 6-32 screw mounting in any position. Each end of the winding terminates at cotterpins, easily accessible for soldered connections. The overall dimensions are 2" x 11/16", the current rating is 125 ma, and the d-c resistance is 50 ohms.

The R-300S R.F. choke has an isolantite form and is wound in a continuous universal winding in three sections. Characteristics include a d-c resistance of 10 ohms, a current rating of 300 ma, and a distributed capacity of 1 $\mu\mu$f. The over-all dimensions are 2" x 11/16".

Both types are available for immediate delivery.

Catalogs

Centralab's new Catalog Number 25, containing the CRL post-war stock line, has just been released. New parts described, illustrated and priced in Catalog 25 include eighteen transmitting capacitors, six high frequency capacitors, three HDC capacitors and twelve Silver Mica capacitors. Tubular capacitors have expanded to include four more capacities in the zero temperature coefficient and seven in the negative coefficient. Five new items have been included in the Trimmer line. The new catalog is available on request from any Centralab distributor or from Centralab, Division of Globe-Union, Inc., 900 E. Keefe Avenue, Milwaukee 1, Wisc.

Condenser Products Company, 1375 North Branch Street, Chicago, Illinois announce their new catalog is now available. The catalog gives all technical data on the Plasticon Capacitors, silicone filled capacitors, A.C. and D.C. capacitors, glass-mikes and energy storage, photoflash and welding capacitors.

THE YL's FREQUENCY

by Amelia Black, W1NVP

SINCE WE SEEM to have neglected the W6's in our listing, this is a good time to give an accounting of some of the sixth district YLs, so you will know what they are doing.

First of all there's Helene Leonard, W6QOG. We owe her a vote of thanks for her help in passing along info for this column, plus an apology for misprinting her name in the June issue. (Somehow it came out Ada.) Helene uses the OM's rig on 10 meter fone, with 400 watts and a four element beam, plus his call of W6MBD. Both Helene and Harry have Class A licenses, and each work separate rigs on 75. Helene's is a new one and runs 500 watts. She and the OM both have their own mobile rigs for 10 and 11 meters. During the War Helene was active both fixed and mobile on 2½ meters for the WERS. She says they had so many hams who were in service visit them, that they called their house "the Edris Street USO." Helene's other interests include deep sea fishing, stamp and coin collecting.

W6QLM is Dot Williams of Los Angeles, very active on 160 before the war, and on the Mission Trails Net. She's also been heard on 10 meter fone. During the war Dot was in the WERS on 2½ meters.

W6QXL is Mimi Raffi of Fullerton, California, another traffic handler, usually heard on 10 fone.

W6RJV is Octa Williams of South Gate, California. Octa holds a Class A ticket, but so far has worked 10 meters only, fixed and mobile. Her rig runs 90 watts, into a beam. She's been handling traffic and having personal skeds for GI's in the Pacific.

K6ROJ, Ella Christensen, is on 10 fone; OM is K6OQM. Ella teaches school. During the disaster of the tidal wave, she handled traffic from the Island, as well as from China and Japan.

W6RUK, Edna Carlisle of Los Angeles, is W6RUL's XYL. Both were at Santa Paula, Brazil, during the war, in civil service. They then went to Argentina, and are now on their way home. Although not yet active on the air postwar, they previously worked 10 meter fone, both fixed and mobile.

W6SPX, Marie Onnigian, operated on 160 from Fresno, California, before the war. Having since married a non-ham, Marie does not have either her OM's or her own rig at the moment. However, she anticipates getting back on the air with the help of her brother when he returns from China, where he is still in the service.

W6TDL is Clara Dishong of Compton, California, who has been holding daily skeds with W6PKB/KB6 in Guam on 10 meters, handling traffic and relaying messages. The 314 Bomb Wing Chapter of the Guam radio amateur league made her a member—the first of only 12 civilians to be accepted. Clara works 10 meters only, into a beam.

W6TMB is June Fredericks of Westwood Hills, California. Her OM is W6SIN (tsk, tsk!!) They operate on 10 fone with a beam. June enjoys ragchews and traffic handling.

W6TWU, Dot Wells, of Venice, California, did WERS work on 2½ meters during the war. She's now back on 10 meter fone.

W6UTZ, ex-W9TAB, is Ruby Ward, who now lives in the San Fernando Valley in California. She holds an operator's license only, and uses the OM's call for the time being. They came to California to work in a war plant and stayed on.

W6MWO, Helen Cook, Beverly Hills, California, holds a Class A license, and worked all the fone bands before the war. She has 600 watts on 10 fone now. Helen is the sixth district chairman of the YLRL and has done a fine job for several years now. She's been an amateur since 1935.

W6UHA, Maxine Willis, of West Los Angeles, worked 20 c.w. before 1941. She now operates on 10 fone. OM is W6TS. The rig is running 900 watts, and she uses a half wave Hertz, Y matched. Maxine is another Pacific traffic handler, and has held weekly personal skeds with Hawaii.

Vera Rathbun, who was W6OHC, of San Jose, California, is now W2OOP/2 at Forth Monmouth in Red Bank, New Jersey, and is back on 10 fone. Vera's the gal who married the K6 she met by air, when she was on the sick list. The OM's call is W2ONM. W2PZA, Jean Grabshied, is a new YL in NYC.

The next meeting of the NYC, YLRL will be on the third Friday in September at the new location at the AWVS Building, 17 East 67th Street, New York City. As a result of their spring luncheon, the membership has increased greatly, and a number of local ham's wives and sisters are studying code and learning theory now. Amongst these are the XYL's of W2ANF, W2BBV, W2CMM, and W2GKA. An-

[*Continued on page 52*]

Verna St. Louis, KL7AX, at her home station running 120 watts input to a pair of 804's in the final. The receiver is a Hallicrafter SX-16.

U H F . . .

by Josephine Conklin, W9SLG*

LAST month, in our first full-fledged UHF column in *CQ*, we were able to report the coming of the 50-mc skip-DX season, together with the fine 144-megacycle DX of W3HWN. Again this month, top honors for interesting news is divided between the six-meter band with much DX work being done—the band being open every day for a week in the middle of June—and the two-meter band with some nice records between California mountains.

Six-Meter Skip DX

Last month, the initial reports to this column covered band openings on May 2, 7, 12, 14, 16 and 24. Starting at that point, things started to get much more interesting. Sometimes long-distance work like the contact of some 1485 miles between W6LSN in Long Beach and W9ZJB near Kansas City, lasted for an hour or more. But let's take the reports day by day.

May 24. W6QAP in Tucson, Arizona, hooked his old friend, W6OVK, in Redwood City, California. Much more activity, however, was reported by Russell Law, W4FKN, who worked the following from Atlanta: W1LLL, W1IHA, W1FJN, W8CLS/1, and W1HDQ, all just before or at noon, and all in Massachusetts or Connecticut. Russ heard W2BYM on both c. w. and phone but did not hook him.

May 29. This was the first opening for Walter Manning, W7ERA, since he returned to Milwaukie, Oregon, from being a Chief Radioman at NAH. He said that W7AVV worked W6LSN and W6QG in the evening.

May 31. The 4th district was in again. W4FKN exchanged calls with VE3ANY and heard W8NKJ in the evening. W4HVV in Raleigh, North Carolina, started off the DX season for Vince Dawson, W9ZJB, at this time. W3CUD says that W2BYM has a rhombic on the band and "about May 30th" worked W9ZHB and W9NFM out in Illinois and Iowa. Harry also said that he personally heard W9HAQ in Davenport, and that W9ZJB was coming through.

June 2. This was a good opening in the West, starting right out at nine o'clock in the morning for W7AVV in Oregon who raised W6QAP in Tucson and said that the other Portland boys were still in bed. The opening was short for W6QAP, but W7DNB got W6ANN, W6TAH, W6CFI, W6RVL, W6IX, W6AOR and W6LSN.

Sixteen-element two-meter directional antenna used by W3HWN, Mechanicsburg, Penna., to set new low-atmosphere-bending DX record for this band on May 15, 1946

Herb, W7DYD in Bothell, Washington, happened to listen in the early afternoon and found the band open for two hours. He was able to work W6AOR, and also W6ANN who was by far the strongest station, blocking Herb's superhet receiver at times. Others heard by him were W6OJV, W6CHH, W6TAH, W6CFI, W6SUY, W6LSN, W6RVL and W6LXL? The latter seems to be the same W6IX who hooked W7DNB.

June 3. This is not a well-reported opening. Vince at W9ZJB got W1AEP in Springfield, Mass. No other reports received by us to date on this.

June 5. W7DNB, W7AVV and W7ERA all raised W6QAP from the Portland-Milwaukee region, in the early evening. Bud Keller, W6QAP, did not even hear another station! This time we got the whole report from both ends.

June 6. Although Vince Dawson sent us the only report on this opening, it was rather a good

[*Continued on page 42*]

*Conklin Radio Company, 6800 Clarendon Road, Bethesda 14, Maryland

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Calls Heard

[*Numeral following call letters indicates signal strength*]

S/SGT A. M. Faries, W6OOU/ETO, 1000 miles west of England
May, 1946
(14 mc cw)

OK3AA; HB9J; OZ5G; G2AX; SM6NZ; SM7YE; LX1AA; XABL; i1LA; G7BR; F8YZ; ON4MEI; HB9BT; LU8AK.

(14 mc phone)

LX1BG; HB1CD; i1MX; YV5ABY; ON4CAL; ON4M; W1JTK/SV; FA8DG; TF2DE; ZB3X; EI2M; SU1SM.

Jack Fern, 3 Hudson St., Clifton, N. J.
March 18 to May 18, 1946
(14 mc)

TF1AA; EP1C; TI2RC; CM2BA; CE2BQ; CO2JJ; CO2SV; CO8MP; CO2PLL; TI2RL; TI2OA; TI2RU; HC2AC; HC2HP; YV6AO; HK4AF; YV5ABY; HK4AN; YV5AN; YV5AE; LU7AZ; LU6AJ.

DX PREDICTIONS

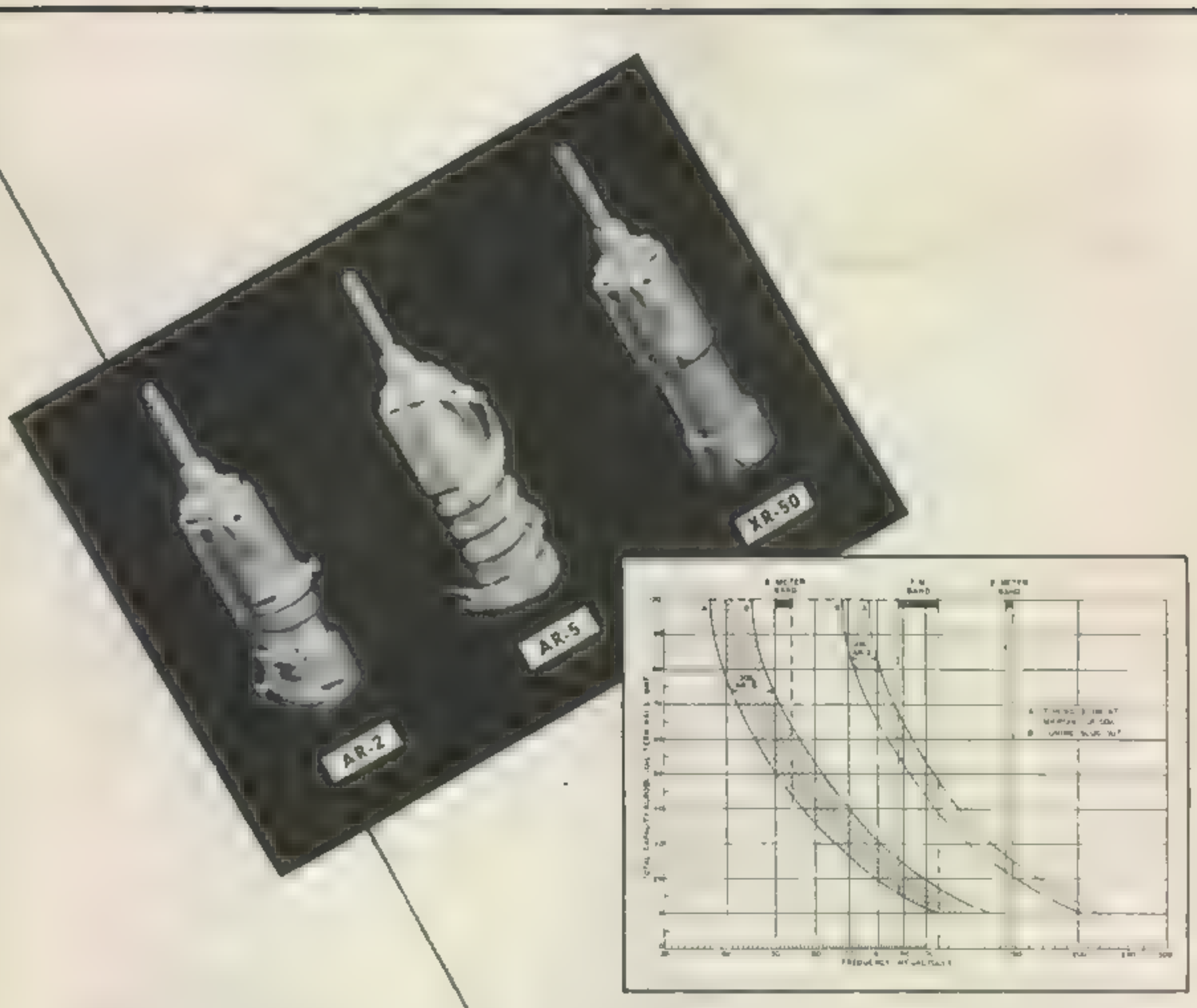
[*from page 32*]

receiver antenna directivities, receiver sensitivity, type of emission (fone or c. w.) and power output.

In *Fig. 1* the predicted conditions are for the San Francisco-Wellington, New Zealand path. This chart will also apply to northwestern W6 and W7. Particularly good conditions will exist on the average days in the afternoon and early evening with ten meter activity after 1400 PST. With a slight decrease in the MUF, somewhat similiar conditions will be found from lower W6 and western W5. Other W5's and W9 will not find the bands so active, though K6 should work almost all the South Pacific areas on 10 meters with little trouble.

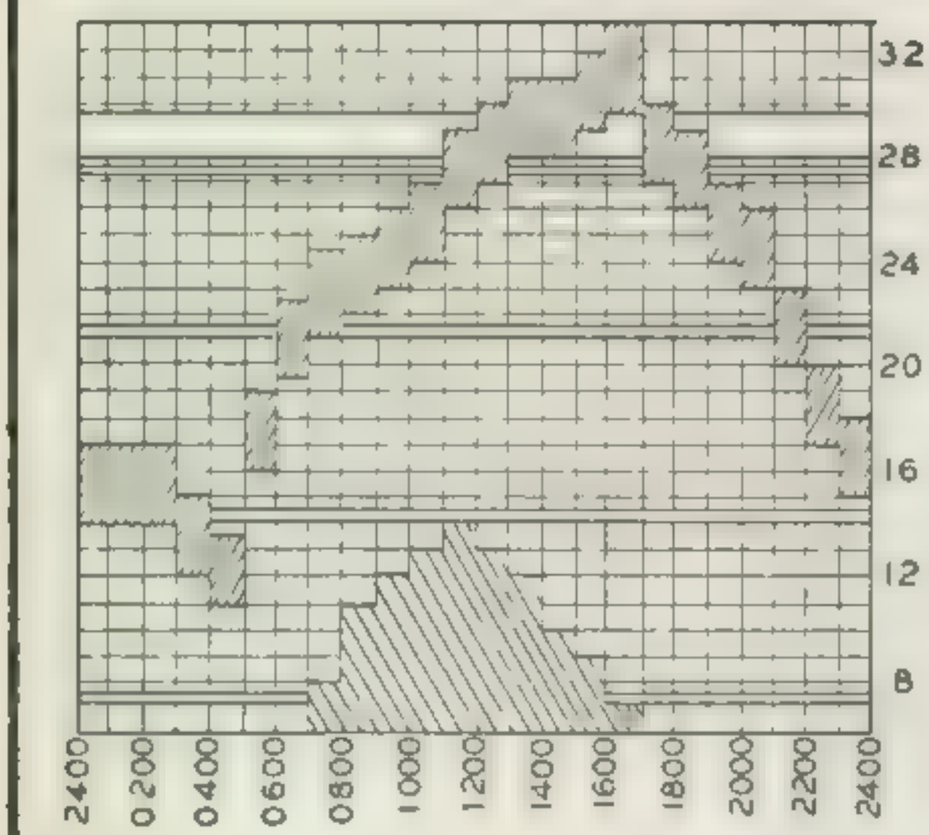
Trans-Atlantic conditions are portrayed in *Fig. 2* and *Fig. 4*. The New York City-Leopoldville, Belgium Congo path in *Fig. 2* shows that conditions will be good on 20 meters after 1200 hours EST. A sharp fadeout will occur on or before 1800 hours. No 10 meter openings are indicated on the averaged days. Both charts in *Fig. 2* and *Fig. 4* are applicable to the Middle Atlantic States, including W2, W3 and northern W4 and with only slight decreases can be applied to W1 and W8.

There still appear some excellent opportunities of working into South America. *Fig. 3* represents the predicted conditions from New York City to Rio De Janeiro, Brazil. Fair to good 10 meter



Here are the postwar high frequency coils amateurs will need for work with the micro-waves. Originally designed to meet Navy requirements, these new high-Q units have adjustable inductance and give fine performance as high frequency oscillators, RF stages or frequency multipliers. Two coils are available covering the range from 37 to 220 Mc. A blank form, Type XR-50, may be wound as desired. All three are small and compact, and all are designed for convenient single-hole mounting.

NATIONAL COMPANY, INC., MALDEN, MASS. U.S.A.



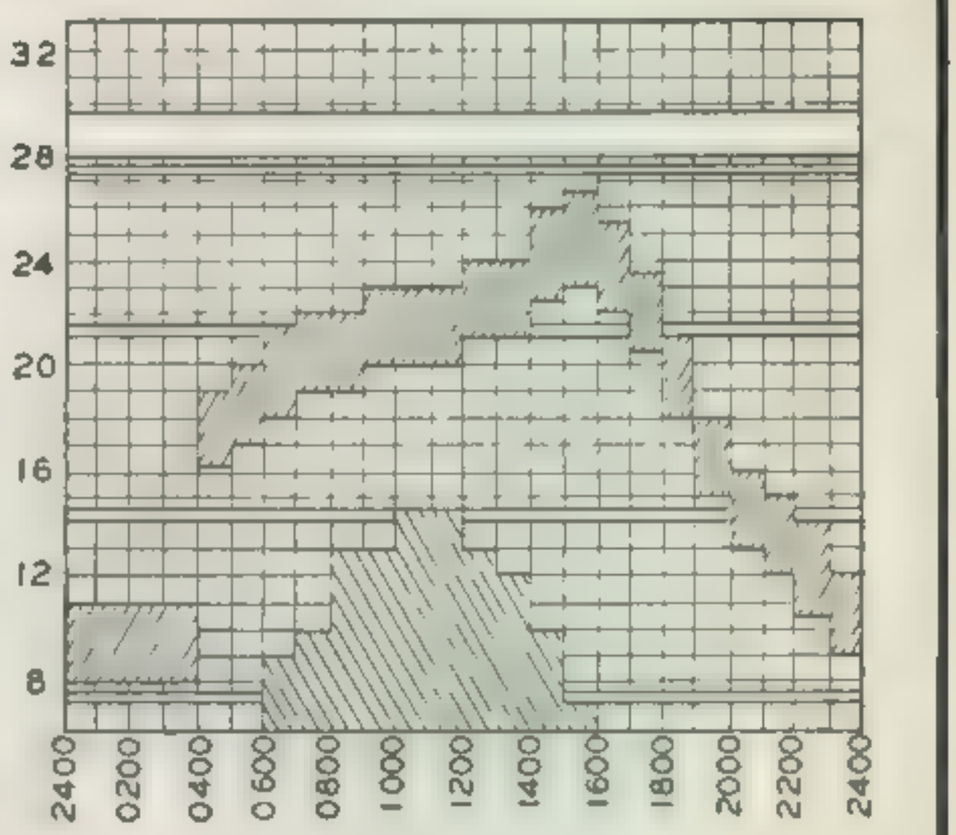


Fig. 3 (left). MUF New York City to Rio De Janeiro, Brazil. August 1946 average. Fig. 4 (right). New York City to Paris. August 1946 average

openings from 1600 to 1800 hours EST. This chart also applies to W1, W2, W3 and W8. With corresponding time values, similiar conditions for W9 and WØ.

August, heretofore considered an especially poor month for DX may prove surprising in the latter part of the month. An overall improvement in transatlantic conditions can be expected with very possible 10 meter openings to Europe in the first week of September. Transcontinental 10 meter activity can be safely expected in the last week of August. Present indications are for an exceptionally lively fall DX season, with 10 and 20 sharing equal honors. Late August and Early September will also see an apparent shift in the DX from the South Pacific to stations as far north as Japan. W6 and W7 should be on the lookout especially for these early openings. Central Americans will soon become very strong on the eastern coast and throughout the middle west.

REBUILDING?

A B&W tank assembly with its exclusive double stator tuning capacitor will give your rig new efficiency. The coil assembly mounts *directly* on the tuning condenser. Tubes may be mounted directly behind. Plate leads will be shortened to a few inches. Built-in neutralizing condensers at the rear permit two short grid leads, thus making a far more compact, more efficient assembly than would otherwise be possible.

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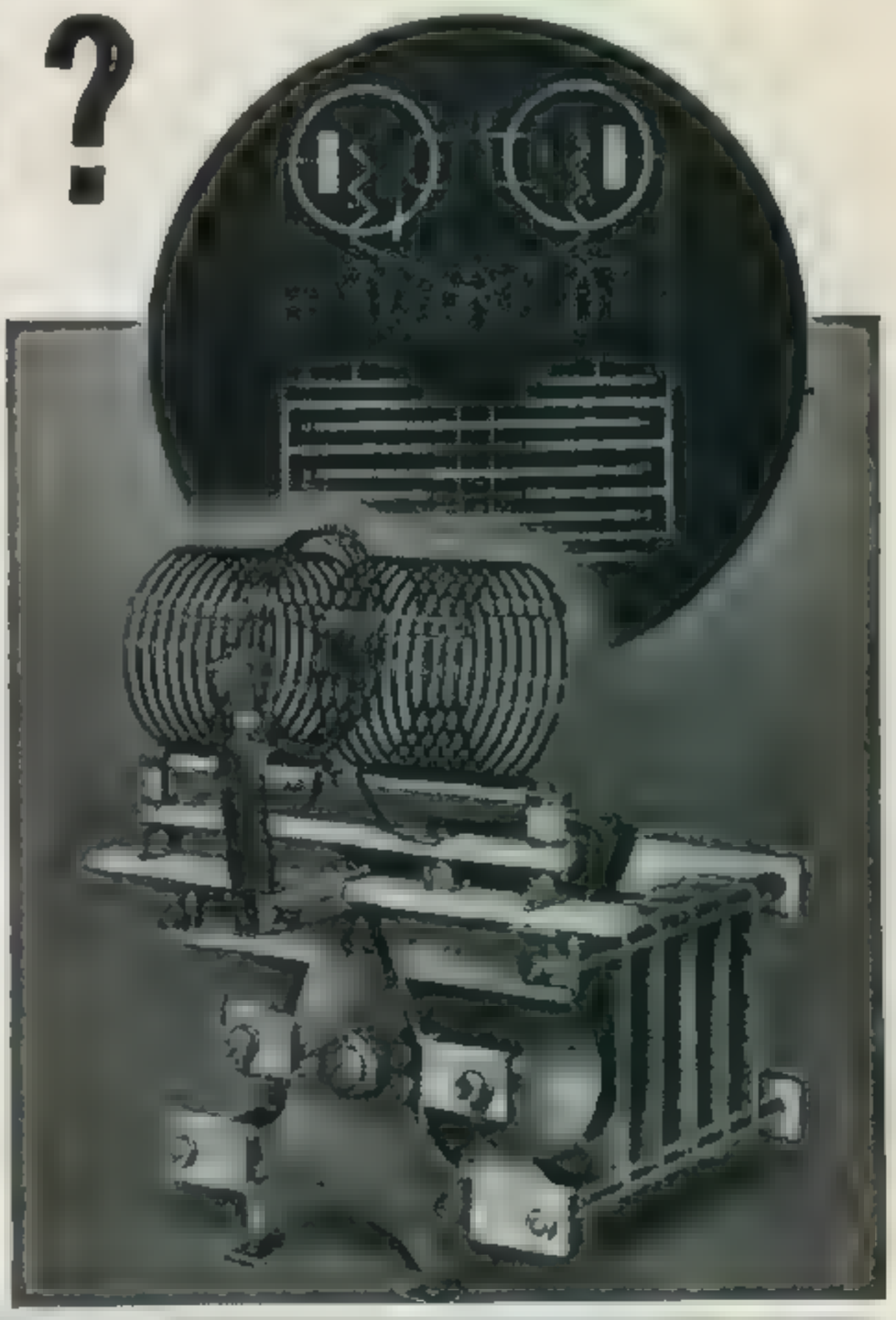

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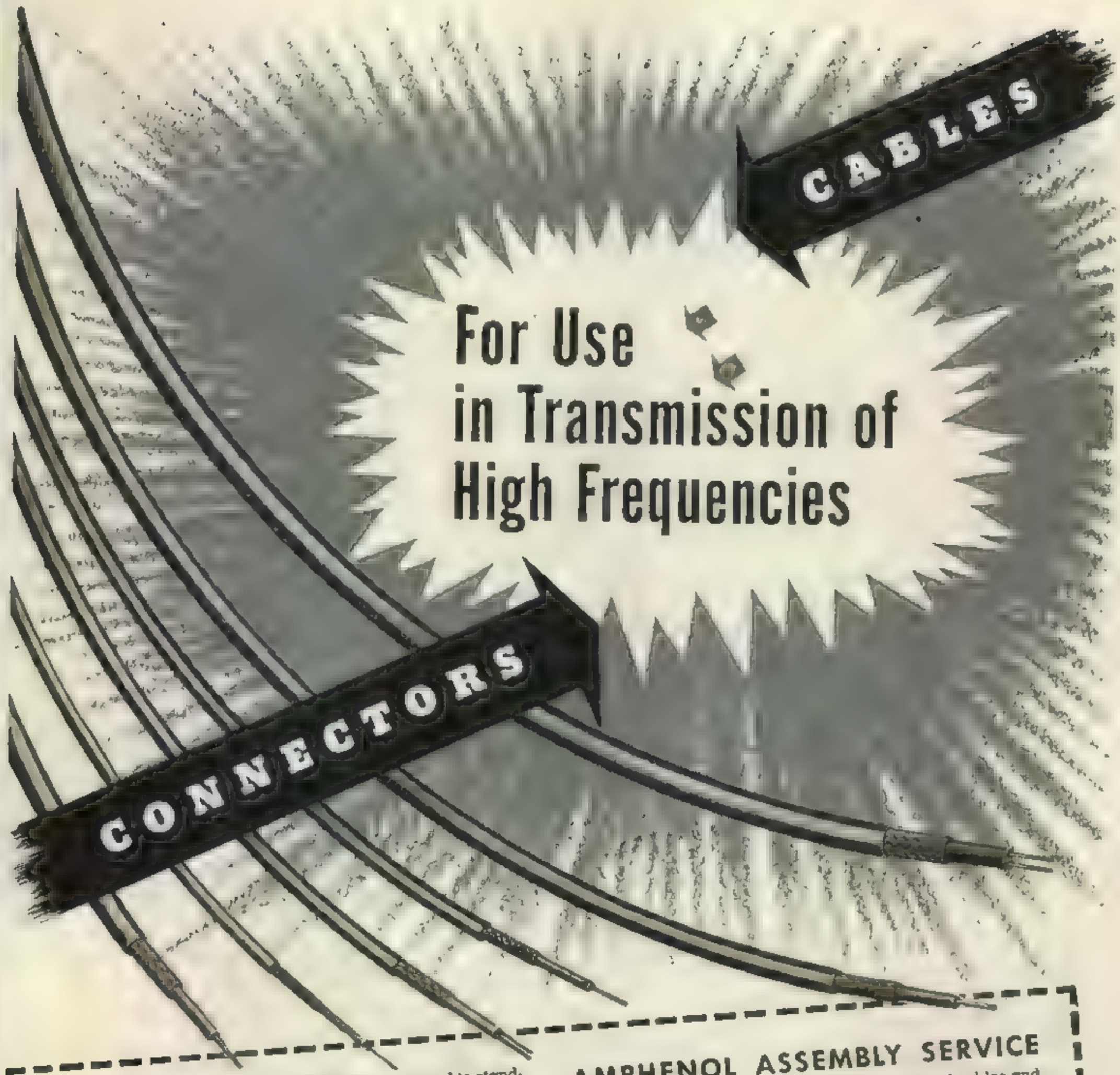

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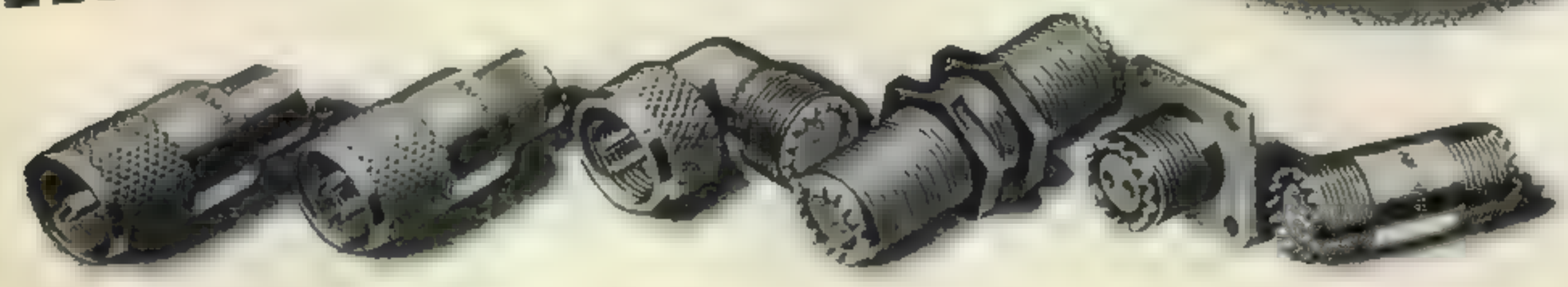

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U H F

[from page 37]

one for him. He raised W1LLL and W1HDQ in Hartford, W1CGY in Athol, Mass., W2BQK in Bergenfield, W2EUI in Roselle, New Jersey, and W8CIR/1 in Waltham. Vince doesn't even bother to mention any calls heard during this evening opening that lasted over an hour.

June 7. Down in Atlanta, W4FKN caught a short opening in the morning when he heard W1CGY on c. w. before fading out.

June 8. Bud and Jim again hooked for another W6OVK-W6QAP Desert Rat contact at dinner-time, with very steady signals. W6LSN heard W9ZHB in Zearing, Illinois.

June 9. While ten-meter short skip was raging into Texas for eight hours, W9ZJB finally did some good by listening on ten meters for replies, which he got from "Pat" at W5EHM who is now in San Antonio but did not have his six-meter antenna up. Vince reports this as a cross-band contact. Ten years ago, Pat used to report more openings to us than anyone else, when he was in Dallas.

June 11. Skip DX started to be a little more wide-spread in area on this evening. Vince made it a two-way this time with Pat, W5EHM, whose signals stayed in nearly five hours—until the 12th of June, in fact. Vince also got W9BDL/5 in Corpus Christi, W5VV in Austin, and W6QAP in Tucson. Vince found signals good enough for contacts lasting over an hour, just sitting back and listening. In fact, he sat back and listened to the W5's work W8's and W9's while being content with only three contacts to Texas—evidently the only three who survived the Alamo, he thinks! This time, W6QAP who now signs W7QAP got W9YUQ/Ø, W9ZJB, W7HEA, W7DNB and W7ERA. He said that Vince at W9ZJB was strong for over two hours, up to the time that Bud turned his beam to the northwest where the W7's were waiting. That is a task for him, because his three-element beam rests on top of the chimney and requires a climb to the roof to turn it. It was a spotty opening in Oregon lasting only a half hour or so when W7DNB and W7ERA worked W7QAP and reported hearing W6STB and W6LSN.

June 12. This was a surprising opening for Vince at W9ZJB who found W9YUQ/Ø at Manhattan, Kansas, 110 miles away, weak and fading instead of R8. Then he raised W7QAP, who faded out. When tuning the band after a QRZ, Vince was called by W6LSN in Long Beach who remained around R8 for an hour and a quarter. The latter tried to get W6QG in on the contact.

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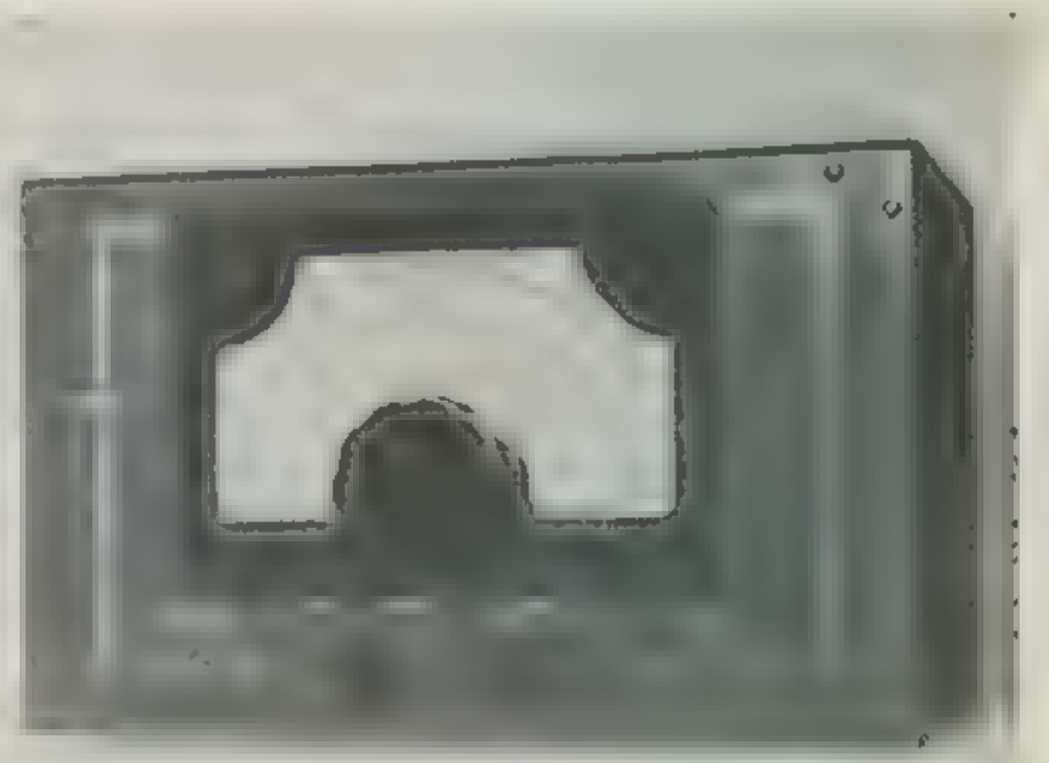

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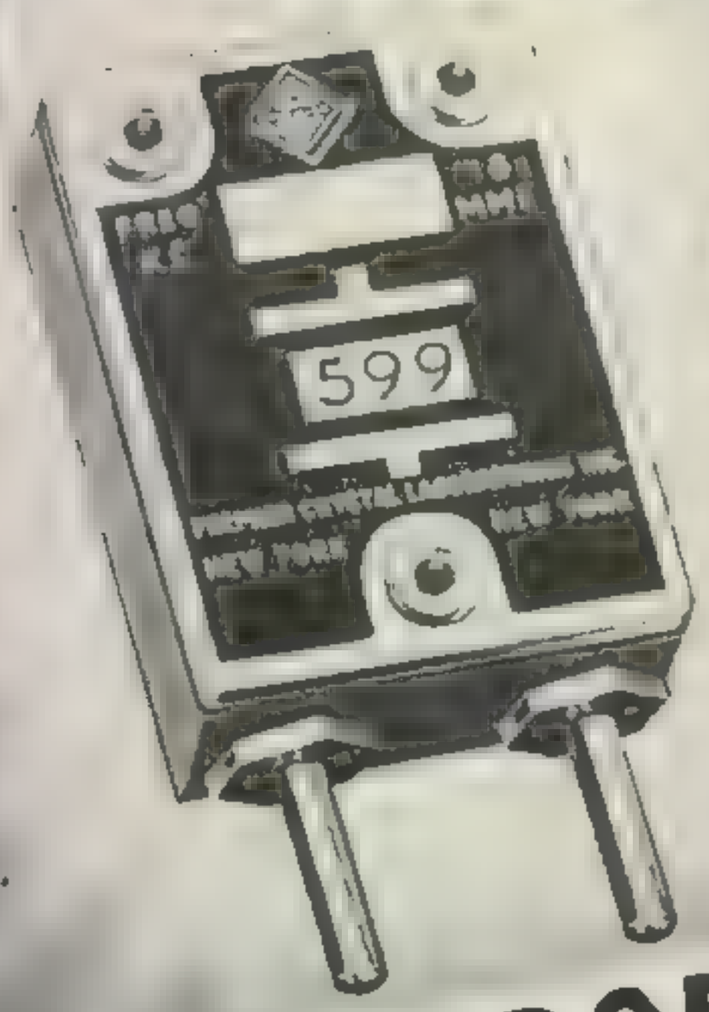

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Act now! This offer expires Oct. 15, 1946. It is being made only to acquaint you with the new Premier 599 Crystal. Check its features—then fill out and mail the coupon today. Just enclose check or money order. Be sure to specify frequencies desired. We will fill orders from stock to within ±5 KC. Crystal units are calibrated in a factory standard oscillator (18 mmf.) to the nearest integral kilocycle and may be relied upon within ±500 cycles of the nameplate frequency.

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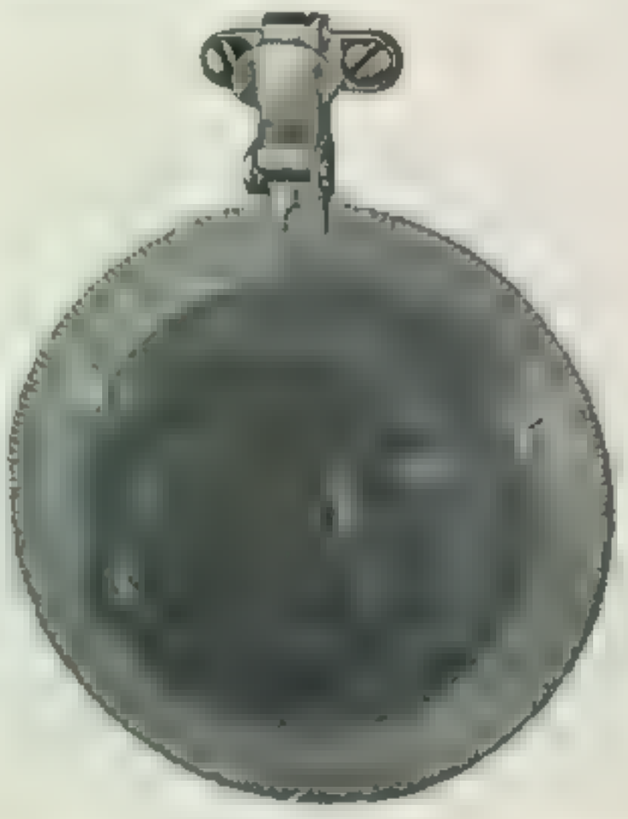
DL-1947 is a new addition to the BUD line and fills a need of long standing. It is a precision unit especially designed for apparatus requiring an accurate, fast-acting dial-lock and tuning indicator.



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Then Vince hooked his old friend W7GBI/6 who also was at Long Beach, and heard W6NMW then W7QAP again. The odd thing was that Kansas City 28-mc stations heard only a weak W3!

June 13. This was a solid opening in Oregon for two and a half hours of real VHF pleasure like old times. Walter Manning at W7ERA worked W7GBI/6, W6ANN, W6LSN, W6RVL, W6CFI, W6AOR, W6TBS. He heard W6AQJ, W6HDY, W6IX, W6GYE, W6PFE, W6VDE, W6OJV. The loudest signals were from W6ANN, W6AOR and W7GBI/6 who were R9 plus.

W7AVV said that even the 3 and 4 watt boys were R9 plus when he worked W6ANN, W6AQJ, W6OJV, W6HDY, W6LSN, W7GBI/6, W6RVL, W6CFI, W6AOR, W6VDE, W6TBS and W6GYE.

W7DNB duplicated W7AVV's list and added W7QAP down in Tucson. W7DDG with converter troubles worked W6GYE and W6RVL before he gave up to rush over to W7DNB to witness the rest of the opening.

June 14. This date started in Oregon, it seems, with W7AVV raising W7QAP at noon. Two hours later, W7DDG got W7BGI/6. W7HEA missed the DX by working someone on two meters while being called plenty on six. Then there was a four-hour opening in the evening from Massachusetts to California, for Vince Dawson when W9ZJB hooked W2BYM in Lakehurst, W3HDJ in Delanco, W3AXU in Trenton, W3CGV in Wilmington, W8CLS/1 in Waltham, W1HDQ in Hartford, W1MUX/3 in Washington, W7QAP in Tucson and W6OVK in Redwood City, California. This latter contact appears to be about 1485 miles for the best six-meter DX reported to us.

June 15. Day after day, Vince finds the band open—evenings when he works and mornings on week-ends. This time, starting at nine o'clock in the morning, he got W2BYM, W3AIR/3 in Maryland, W4HVV in Raleigh, W1QB/3 (Web Wilson, brother of Mel Wilson, W1DEI/3), W8RUE in Pittsburgh, W9STX/3 in Washington, W4BBR in East Point, Georgia, and in mid-afternoon, W5EHM in San Antonio. It looks like Vince is out after W.A.S. on six meters! Remember, he was the first station ever to work all districts on five meters. His states worked, however, were tied at 31 with W9CBJ, and bettered by W8CIR with 35, W5AJG with 38, and W9ZHB with 41!

June 16. Another morning opening for the convenience of Vince Dawson for his score at W9ZJB. Getting on the air before nine, he worked W8VIB in Three Rivers, Michigan, W3HDJ in Delanco, New Jersey, VE3ANY *in* Lakeview, Ontario, and VE4DG in Winnepeg, Manitoba. [*Continued on page 46*]

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*RG-39/U	73 Ohms	.312"	11c	8c
RG-58/U	55 Ohms	.195"	8c	5c
		TWINAX		
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Crystals for the Critical

Two-Meter DX

Then a week later, in came a letter from Arthur Child, W6TYP, who said that on June 8th, W4TZ/6 on Goat Mountain about 75 miles north of San Francisco worked W6RBQ in Grant National Park east of Fresno in the high Sierras, for a new two-meter record which he gives as 280 miles.

Art also says that W6NJJ worked W6RBQ at a distance of 250 miles with R9 signals each way. W6NJJ was on Mt. St. Helena, 65 miles north of San Francisco. They used 16-element arrays like the W3HWN job pictured this month, and the one W1HDQ uses and described a short while ago in *QST*. W6NJJ was putting 12 watts on push-pull 7193 tubes; W6RBQ had 50 watts input, supplied with a gasoline-driven generator.

Art did not do so badly himself from the top of Mt. St. Helena, in working a station 93 miles away. He was putting only a third of a watt into a six-element Yagi array; the transmitter is a 1G4GT and 1Q5GT parallel-rod job that he has been using since the middle of 1941. His receiver is his "portable-pedestrian"—apparently the same two tubes used as a transceiver.

E. Miles Brown, now W2PAU but formerly W1IRV, spent Memorial-day week-end in the Pocono mountains with W3EKK and W2PFQ. They had three 40-watt transmitters. They used W3EKK's super-superheterodyne receiver and what they report as a rather fantastic corner-reflector antenna mounted on a car. They could work 70 miles to W3BNU in Hatboro, Pennsylvania, at any time and he uses only a TR-4. They also hooked W3BM in Minotola, New Jersey, at about 140 miles but the latter says nobody knows where Minotola is from hour to hour because the sand keeps shifting. They got into Philadelphia, Allentown, Lancaster, W3HWN in Mechanicsburg near Harrisburg, and W3HOH in Bernardsville, New Jersey. The latter claimed that he nearly died of shock when he hooked a portable in W8, but recovered enough to line the boys up with W2FJQ in South River, New Jersey. They heard many strange W2 calls including W2BZA, W2MQS, W2MWA and W2ER but concluded that either the New York City boys need better receivers or are interfering with each other so much that DX doesn't get through.

Out there in the flatter areas in Gary, Indiana, Herb Brier at W9EGQ is doing all right with his 15 watts on a self-excited HY75, a super-regenerative receiver, and quarter-wave-spaced four-element antenna. On Sunday, June 16, he and W9NQS in Rockford, Illinois, heard each other well over a hundred miles apart and with different antenna polarizations. W9YQI in La Grange, Illinois, worked him and also heard W9BLY in Rockford, also cross-polari ation

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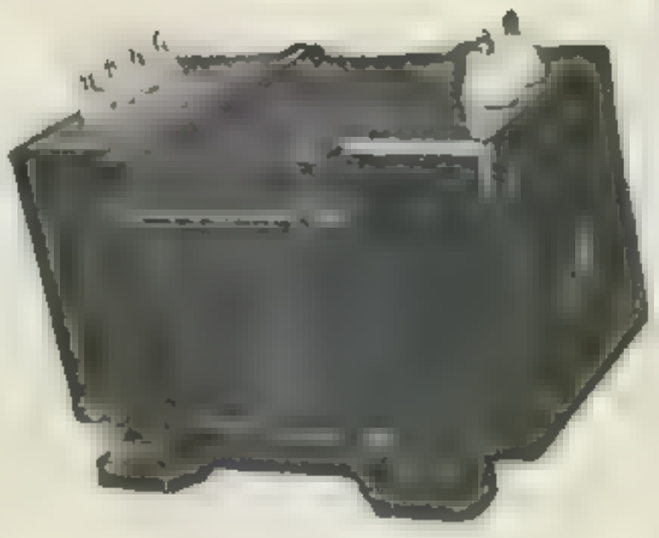

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Langevin **SWING CHOKE** – 400/50 mils—4 henrys—DC resistance 72 ohms—insulated 10000 volts—Perfect for Class B modulators, size 7⅛" long 5¼" wide **$12.75**

TEST EQUIPMENT

METERS

"S" METER—1 mil movement—0-10 scale..... **$3.95**

MILLIAMMETER—0-800 mils. Weston No. 301 ..... **$4.95**

Cramer **RUNNING TIME METER** 110 volts 60 cycles, reads to 9999.9 hours **$4.95**

Hewlett Packard **200B AUDIO OSCILLATOR** 20-20,000 CY.—Delivers 1 watt into 500 ohm load and 25 volts into open circuit - No zero set required—units have been reconditioned and are guaranteed same as new **$74.95**

Western Electric **MULTI-TESTER** Volt-ohm-milliammeter—accurate to better than 1%—reads to 1 megohm, 0-300 volts AC or DC in four ranges—reads to 15 amps.—with external multiplier (not furnished) meter will read to 3000 volts—with test leads **$27.95**

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SPEECH AMPLIFIER designed for the Collins **ART 13** transmitter from carbon or dynamic mike to 811 grids—contains grid input trans.—side tone amplifier to monitor your signal—answer to your audio problems—uses 2 6V6s-1 12SJ7—tubes not included—complete with schematic . . . **$7.95**

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COMBINATION OFFER -Thordarson T02R21, 380 volts each side of center at 200 mils—5 volts, 3 amps—6.3 volts, 5 amps CT and matching choke T74C29 150 mils, 15 henrys at rated DC -200 ohms DC resistance—These units have been removed from new equipment—Fully guaranteed—List price $10.50. Your Price **$7.25**

MODULATION OUTPUT TRANSFORMER —ratio 2-1—designed to operate from 811 tubes in Class B to drive 813 in Class C—will modulate both the plate and screen of the 813—has separate screen winding **$4.95**

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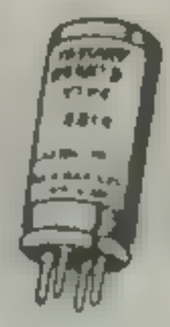

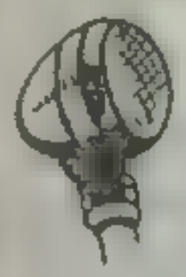

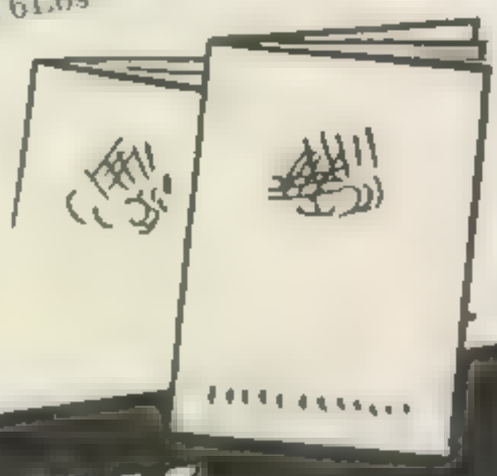

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On June 18th, Herb says that W9JPK, W9GMV and W9CIB in Milwaukee were putting rocking signals down into the Chicago area, the first two using 16-element arrays. W9YQI in La Grange first established contact with W9JPK, and then others were worked in. W9DHJ in Crown Point, Indiana, heard both W9JPK and W9CIB. Herb at W9EGQ first heard W9JPK when his beam was 45-degrees off and was biting his nails because he could not put the beam right on Milwaukee.

California Super-DX Tests

They do things in a big way out in California. This issue will come out just after a super-colossal 144-mc attempt which we can all hope will be successful. We tried to squeeze a last-minute announcement of it into the last issue. Here is the plan.

Art Child, W6TYP, is going up Mt. Shasta in Northern California to its summit which is 14,191 feet, all day Saturday and Sunday, July 27–28. W6OIN will be on top of Mt. Frazier near Bakersfield, which is 8064′ high; he will use 50 watts input and a four-element antenna array. W6QZA will be on the Coast Range near Santa Barbara. It is hoped that numerous other two-meter stations will be on Mt. Tamalpais, Diablo, Hamilton, and so on. W6TYP and W6OIN say that they are shooting at a 504-mile record down the Sacramento-San Joaquin valleys, but will also be listening for Pike's Peak in Colorado and the land of K6's in case they are too pessimistic about the possibilities. Art feels that the sporadic transmissions that were heard on 127 mc during the war indicate that anything may happen when propagation characteristics of this frequency along tropospheric ducts or by other means from great heights.

Two-Meter Activity and Equipment

Bill Smith, W3GKP in Silver Springs, Maryland, tells us that up to the first thirty miles, at least, the band goes dead when the antenna polarization is changed from vertical to horizontal here in the Washington area. That suggests that one solution might be to settle upon one polarization for unstable transmitters and upon radiating super-regenerative receivers; and upon the other polarization for stabilized transmitters and non-radiating receivers. What do you think, gang? Will this do the trick?

A compromise on the situation would be to give a small part of the band—say half a megacycle or so—to the stable boys and move the unstable ones into the large remaining part. This is somewhat comparable to the idea of a c.w. band on ten meters, in which the phones are not permitted—at least USA ones.

C. H. Jenkins sends us a summary of Phila-

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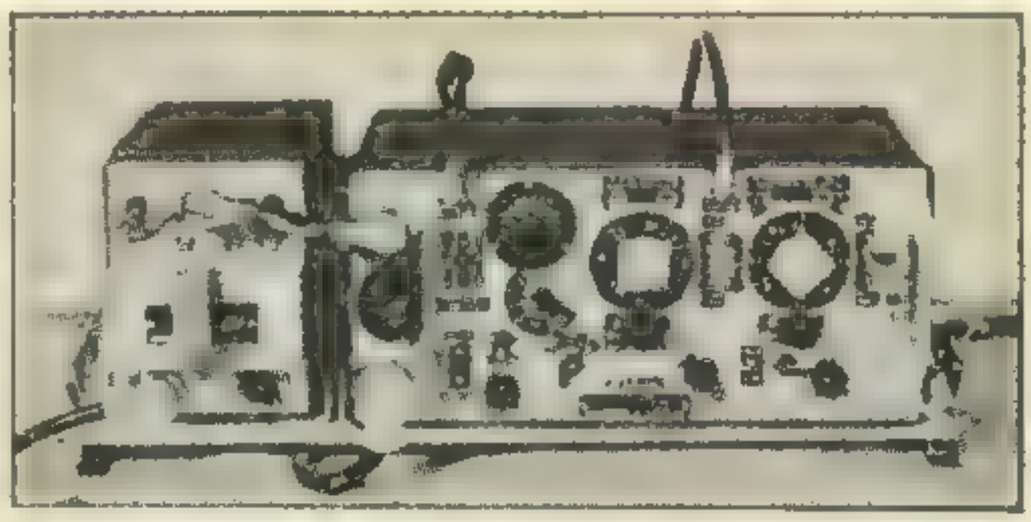

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delphia and South Jersey activity as he gets it at W3VX. The two-meter gang is trying to institute a "listening period" in order to hear DX. The idea is for everyone around there to remain silent and to listen for mobile rigs in the hills—and better DX—during the five minutes before the hour and half hour. Jenkins wants somebody to hold an umbrella over his 300-ohm twin-lead feeder on rainy days, or to provide some better solution to his problem.

Recently, W3CWR was working a weak signal, requesting the station to knock more of the noise out of his receiver so he could receive better. W3UQM and W3VX came to the rescue by cooperating to put their carriers on the air and suppress W3CWR's receiver hiss for half the band.

W3AKI is planning to get on the band soon as W2AKI. Say, how many stations will be using the same call, if that keeps up? W3JWW is having creeping trouble; perhaps he will be up to a "walk" soon. W3VX says that he puts 70 watts into his tube on 147 megacycles; about 20 watts leave the antenna and 15 stay in the speech amplifier.

The other night, W3GKP outside of Washington heard a nice signal from Brownie, W2PAU, six miles out of Camden—but after getting up to R6, it went out.

More from the Philadelphia-Camden area comes from Brownie who, since the first day the band opened with plenty of activity, has worked over a hundred stations. Most of these are still active, he says. Even during the day there is usually someone sitting there listening and waiting for a rag-chew. A CQ gets results at any hour. At night—well, if he wants less QRM he says he will go up to 75 meters.

There are plenty of mobile stations in the area, and several of the fixed stations have put up directional antennas. W2PAU uses a four-element arrangement which is similar to two W8JK beams in parallel, using vertical polarization. He says that if that fellow from New England who is advocating horizontals would listen around Camden where there are very few hills and other obstructions to diffuse the signals, He would know why; unless everyone changes at once, it seems that vertical polarization is there to stay. The band sounds dead when Brownie tilts his antenna over to horizontal. Others who use the W2PAU array are W3GMY, W8CYN/3, W3KEI, W2PEN, W3IZU, and W2EUY.

As for results, W2PAU is not doing too badly. W3GMY in Vineland, New Jersey, held the record for a while, with W3BM in Minotola giving him some competition, using only a TR-4. W3BM is working on a high-powered rig and sixteen-element antenna. He and W3EKK, W3GQS, W3GQK and W3BYJ have busted through to the New York City area on rare oc-

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casions, while Lancaster stations are heard and worked quite frequently. W3LN in Lancaster says that he hears Philadelphia two-meter stations consistently and feels that if those with the better locations will put up directional antennas and improve their receivers, he can make that haul an every-night occurrence. W3JDP in Holly Oak, Delaware, seems to be able to hear them and work them with his m.o.p.a. and directional antenna. W3VX, W3CGV and W2PKT (formerly W3ABQ) are putting out good signals.

Harry Densham, W3CUD, says that it was W9GBA/3 from the Naval Research Laboratory who went to Skyline Drive in Virginia and worked W9GRR/3 mobile. Harry says that is 140 miles, but we haven't the data on the exact locations involved.

In the vicinity of Sacramento, according to W6CLV, the following are active on 144 mc. W6GZY, W6KME, W6MIW, W6PIV, W6CLV, W6BVK, W6QKJ, W6GDJ, W6MGC. Most have worked from Sacramento to Mt. Diablo, about 75 miles airline. W6CLV, W6GDJ and W6KME are also operating mobile. Others in the area are W6EUL in Vallejo, W6CAN in Napa and W6LUM in Corte Madera. Lloyd claims that there are a million on the band in San Francisco and vicinity, including W6NJJ, W6RBQ, W6UJS, W6MAZ, W6JO, W6TCP, W6ERS, W6VNH, W6VQB and W6FQZ. He says that W6LSX in Watsonville works into Hayward and San Leandro consistently, a hop of 90 miles over the countryside. The only one on the band in Salinas is W6VQK but W6LLW expects to be on soon.

Nearly every week-end, Lloyd goes up to Twin Peaks at the foot of Market Street—or is it the head?—in San Francisco, working out about fifty miles consistently.

W6TYP says that the most popular single tube in the San Francisco area seems to be the 7193—a class A service 6J5—which runs a conservative maximum rating of 62 ma at 400 volts, or 25 watts per pair. They have most use in a parallel rod circuit, showing good efficiency.

Activity on 144 mc is increasing around the Seattle area, according to W7DYD of Bothell, Washington, with W7EOP, W7EUI, W7JIE, W7CGL, K7CZY/7, W7IOQ, W7JFB, W7HOL, VE7AEC, W7JBH, W7JKB and W7DYD on the band. Most are using horizontal beams; some four-element closely-spaced arrays, and some 16-element affairs. The local DX is from W7EOP to K7CZY/7, which is 30 miles, but more is now expected because of the greater activity. These two stations use TR-4's with 12 to 20 watts input, feeding 16-element horizontal arrays.

The best equipment in the area is said to be that at VE7AEC at Duncan, British Columbia. He has an HY-75 oscillator and 829 final with

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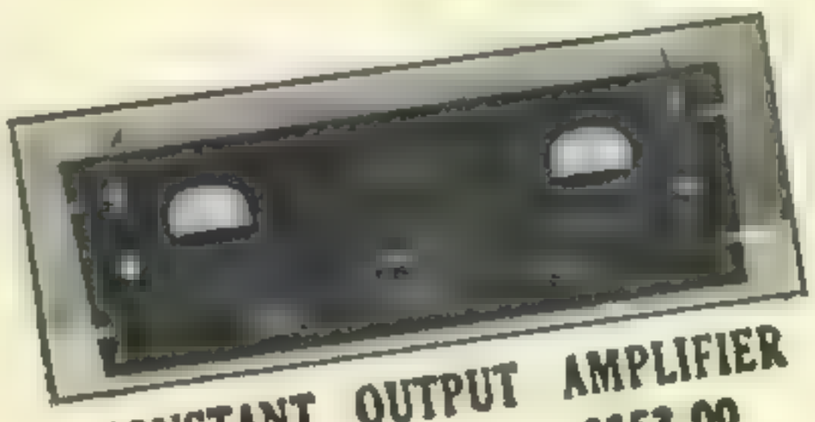

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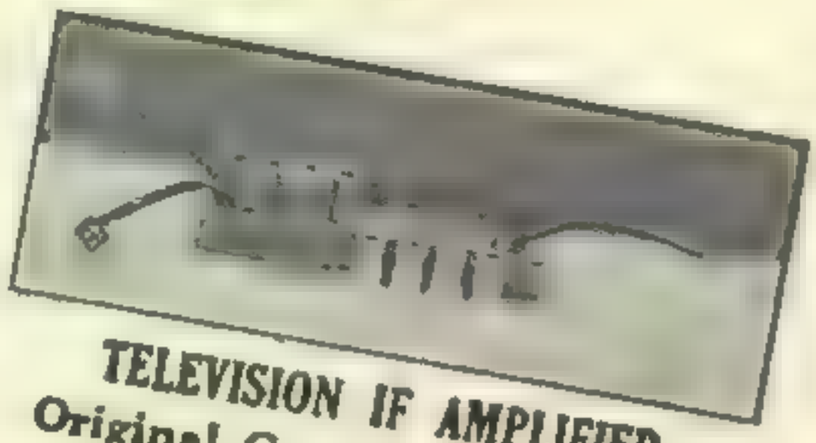

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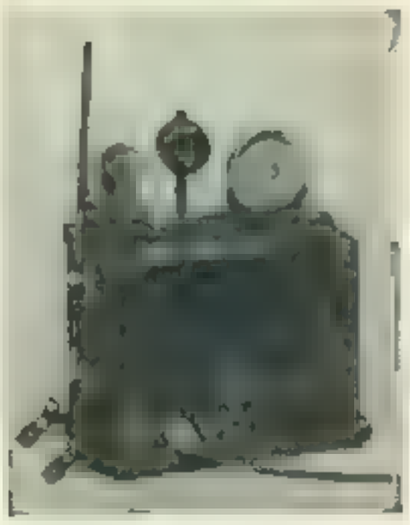

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"TAB," Dept. QS

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80 watts input and a 16-element antenna. His receiver is a BC-1068A Army surplus job.

Joe Addison, W9PKD—now WØPKD, is getting ready to get on the band in Salina, Kansas.

W9BAU and W9JBS in the Kansas City area are using four-element antenna arrays, with walkie-talkies.

Activity around Chicago is picking up, according to Herb Brier, W9EGQ, of Gary, but it is surprising how many are on the air without ever pushing their signals much farther than across the street. W9YQI in La Grange, Illinois, and W9IOD in Elmhurst are the most consistent at Gary, a distance of 40 miles or more. There are two camps developing with W9IOD, W9ZHB, W9NQS, W9BLY and many others west of Chicago using horizontally polarized antennas, along with W9WWH up in Racine, Wisconsin. W9YQI in La Grange, W9RHL in Hobart, W9EGQ in Gary and W9JPK in Milwaukee are among those using vertical polarization. Some DX work over 100 miles has been done cross-polarization, however.

Above 200 Megacycles

Harry Densham, W3CUD, is testing out a 425-megacycle circuit from his Silver Spring, Maryland, location just north of Washington, to another station north of Baltimore. If he makes it, another record will be established.

W1HJI, now W3KJI, has a pair of 8025 tubes on both 235 and 425 megacycles—by sliding the shorting bars. He uses a super-regenerative receiver to work W3CUD. The boys are working on a BC-1068 surplus receiver.

YL FREQUENCY

[*from page 36*]

other is W3KOW's sister, Doris. A new member is Ellen White, wife of W6EQZ/2, who has just taken her own ham exam.

The club is planning code and theory lessons in the fall, starting with a refresher course, and ending with Class A studies. This series will include visits to local ham shacks for those YLs who are still awaiting their own calls and have not yet been on the air.

Verna St. Louis, KL7AX

To many hams in remote parts of the world amateur radio is much more than just an enjoyable hobby. It's an only contact with civilization, an only means of getting assistance in times of emergency.

For most of the past 11 years Verna St. Louis, KL7AX, better known as K7HUT, and the OM, Verne, KL7AV, formerly K7HAI, have realized this, especially during the winter months.

They usually spend their winters trapping red or cross fox, mink, land otters, and muskrat. At times

they go on hunting trips for caribou, geese and duck, or rabbit, which they use all winter. Verna is proud of her shooting ability and calls herself "pistol packing mama," but her pride and joy is a muskrat coat made entirely of the skins of muskrats trapped by Verne.

During these periods in the woods—miles from the nearest village—they see no one for months at a time. It is then that Verna says, "Amateur radio is really a wonderful thing in Alaska because it serves so many people who would otherwise be isolated. It has been responsible in a number of instances for saving lives when no other means of communication was available. So far we have never had to use our station in a life-or-death emergency, but it gives us a feeling of contentment to know, when we are miles from anyone, that we can get in touch with the rest of the world if need be. Other than that we just plain enjoy talking to anyone who will answer our CQ."

Their usual rig at these remote cabins has consisted of a 6L6 with 30 watts input, powered with a six volt vibrator pack. A wind charger charges the batteries; lack of wind is never a problem! Receiver is an SW3.

Only this past April they had the sort of experience that was a thriller. In Verna's own words. "Maybe you've heard of the tidal wave that was due here at Naknek last week. You see, I have been operating the only transmitter in town. It's an airways company outfit and has only two crystals, both airways frequencies, but I have also been in contact with the Signal Corps about 15 miles up the river. There is no other means of communication at the present time, and so twice a day I handle the wires to and from the village.

Well, it all started one day when I was just getting ready to wash my hair. A fellow came running to say that the Marshal wanted me immediately. We couldn't imagine what was wrong, so I just tied up my hair in a scarf, slipped on my boots (it was thawing some) and ran down. Part of a transmission about a tidal wave had been overheard and I had to get on the air to see what the score was. Luckily I contacted Anchorage right away; and sure enough, the wave was way down the chain from here, but was a 90 footer and was due to hit Naknek at eight thirty. This was about five thirty. What to do and not start a panic was the question!

It so happened that there were two planes in the village, which immediately started taking women and children to the Army base. At seven thirty with the wave 65 miles south of here and traveling at a

---

The FM adaptor, scheduled for July CQ, will not appear until October. We regret any inconvenience to readers, but the delay was unavoidable.

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Through a process equal in every respect to war-time infiltration, V.H.F. DXmen are learning via off-handed comments that the basic theory and conception of extended groundwave 6 and 2 meter DX-ing has changed. And indeed it has; new terms like superrefraction, wave-trapping and atmospheric ducts have suddenly appeared. Press dispatches indicate that the U. S. Navy plans extensive experiments with V.H.F. radio waves capable of working seemingly incredible distances. Radar meteorologists predict that weather will be forecast with the aid of U.H.F. and V.H.F. radio waves hundreds of miles away. What is the story behind all this speculative talk? CQ Magazine is sparing no effort in bringing the amateur and experimenter the latest information. Within the near future a basic story of this new principle will appear. Look for it!

speed of 35 miles an hour, we closed down the station, and those of us who were left began to hike.

You see, it's all flats and to find any high ground was nearly impossible. We finally hiked out to one of the canneries, and climbed a ladder to the top of a 50 foot high water tank. There we waited and listened until around ten o'clock, when we felt that it was safe to go to the cannery watchman's house and get the latest radio reports. They were coming in thick and fast, still full of warnings, but by twelve thirty when nothing had happened, we hiked back to town, and I was back on the air by one thirty.

I never left the mike until three p. m. the following day, and that's about as all in as I ever hope to be. My voice practically left me, and I was too tired to think any more, couldn't even remember the station call letters. During the day we had gotten reports that the wave had hit down below us, and was still on its way. The planes returned and took more and more people—Verne finally said I had to go, so he took over the transmitter.

Miraculously, the wave by-passed us completely, but where it did hit an Alaskan Coast Guard Station it killed five men, and, of course, did enormous damage in Honolulu. Had it hit, with us unprepared, the result might been tragic, and here was a case where hams were able to help the whole village." The most refreshing thing about Verna is the

casual and amused way she accepts Alaskan conditions. She tells humorously of encounters with bears, mentions casually getting snowed in for three days in the mountains. Admits to a "rather windy day" with the north wind blowing at 98 miles an hour, garbage cans clattering down the streets, roofing paper falling off houses, and windows breaking all over town. When it gets down to 25 below zero, with two oil stoves going, and the water running constantly to keep it from freezing, Verna concedes it's cold!

CQ DX

[*from page 54*]

final, with about 800 watts input. 6EAK does all of his work on c.w. and the second day of the 20-meter band opening, he worked W2OAA/J8, KA2SD in Samar, W9HJW Saipan, CR9AG (who incidentally is old VS6AG) VP4TR Trinidad, W4HRP/J3, PK6TC, VK9AZ, W1DTS/CT2, C3YW in Foochow, and VS1QB in Singapore. Court wants to know how come a lot of the boys are operating between 14,000 and 14,100 kc. Frankly, I don't know either. Only reason which I can think of at the moment would be that a certain few of the DX gang assumed when the 20-meter band opened it would naturally be the same as pre-war. I would rather imagine the FCC Monitor stations as being very busy during the first few days after 20 opened.

Look who's here. Our old friend, VK2NO. It's swell hearing from Don again after a 6 or 7 year layoff. VK2NO has been operating on 10 meters, but now that 20 is open I imagine that he will be blasting away again on this band. Don is still keeping his hand in amateur journalism by writing "Calling CQ" in the "Australasian Radio World." He said that he kept an eagle eye open for some of the GI hams who must have visited Australia during the war, but he guesses most of them were afflicted with "YL-itis" when they were off duty. The few he did meet were, of course, on duty.

Lifting a little stuff out of Art Milne's (G2MI) column in the RSGB Bulletin, we see W9OLD/TA is operating in Istanbul on 28060. QTH of OQ5BQ is Box 222, Leopoldville. G2MI also reports that VE5AJU/VP8 was operating aboard the cruiser, "Uganda" in the Falkland Islands. He was using the ship's transmitter. QSLs may be sent via 320 Moss Street, Victoria, B. C. The QTH of VQ6MI is Sgt. M. Norman, c/o East Somaliland Signals, British Somaliland. VU7BR is active on 28120. VS5JH is still in Labuan, but is now signing VS3JH. Then there is YR5X, 28080 and YR5A, 28040. G4JG is in Turkey, trying to get permission to operate a station there. So much from G2MI's column.

One of the boys phoned the other day, wondering if I had listened to the broadcast of the "A" Bomb test at Bikini. I said, "Yes," but thought it rather disappointing from a broadcast view-point, whereupon this ham came back with a remark that he thought it was the most realistic broadcast he had ever listened to. I bit when I asked why, and his

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explanation is something like this. He was sitting there, listening to the build-up prior to the release of the Atom Bomb, and at the instant the Bombardier yelled "Bombs away," a cloud of smoke poured out of his BC set, and now he wants to know if television could do any better. Yes, it was the transformer that gave up.

A card from W8PQQ gives his reaction to starting over in countries and zones. His answer is short and snappy—"*Definitely not.*"

Our old friend W2GTZ was heard from. He has a different location which is now in Jamaica, Long Island. During the war GTZ was with the Navy at Anacostia, D.C.; then came back to Western Electric, and then went to Mexico City or 13 months. He seems to think his high power days are over but he's definitely going to get on the air with something. To start with he's going to settle for a pair of 812s and fix up some sort of an antenna on the roof of the apartment building in which he lives. Better get cranked up there, Reeve.

It has been swell hearing from the newcomers to the DX gang, as well as all of the old-timers. Keep up the good work and shoot in the stuff to us as I believe the whole DX fraternity is always anxious to see what the other guy is doing. A few of the boys have griped a little because of frequency inaccuracy, likewise the lack of frequency shown for some DX stations. My problem, Mr. Anthony, is this: With an apparent majority of the fellows using v.f.o. of some kind, what frequency are we going to report? Even with the few contributions thus far, I have noticed as many different frequencies for a few DX stations as there are reports. I would like to find out what you fellows want done. Shall we continue to report the frequencies and assume that they are approximate, or shall we only report those which we feel will be a help for someone in locating the station. What do you say?

That's about the end of it for this time, but I'll be looking forward to getting regular contributions from all of you. I don't know why it is, but old QD worked a W9 for the first QSO on 20. As a matter of fact, that's about all I have worked on 20. I think I will be getting my spurs sharpened, climb up my 60 ft. telephone pole and get that 20-meter antenna really up in the air. I suppose W2IOP and yours truly have something in common. Enough of this chatter; let's hear what some of you are doing on 40.

CATHODE-COUPLED AMPLIFIER

[*from page 19*]

stalled on the chassis, the tube and the components involved should be mounted within a small shield, as shown in the photograph. A shielded cable may be used to connect the leads to the receiver power.

In all cases it is highly desirable that the installation be made permanently and that the voltages required be taken from the receiver itself. This procedure will make it unnecessary to run new cables to the adaptor, and will, in no case, draw enough power to affect the receiver.

If, for some reason, it is considered desirable to take the supply voltages from the adaptor, this may also be done without considerable trouble.

It may be noted that under certain circumstances the plate coil of the mixer tube may have to be re-trimmed slightly in order to obtain full effective use of the cathode coupled amplifier. When this is done, the gain of the receiver should be the same with the cathode coupled connection in place as it was without it. This circuit of the cathode coupled amplifier increases the Panoramic Adaptor gain by three to four times, giving a corresponding improvement for signal-to-noise level.

The drain of the B+, to which the cathode coupled amplifier is connected is on the order of one-half to one milliampere. The B+ voltage is not critical and will not affect the performance of the cathode coupled amplifier.

PROPAGATION

[*from page 31*]

cation on a relatively low night frequency, the ship-to-shore circuits are always severely congested. To the east of a shore station the higher frequencies become unstable as the morning progresses, but since it is also the custom for shipboard radio operators to listen for the shore station and call on the frequency which is best received, the shore station is not heard at all on the higher frequencies, although at some time in the morning, ships to the east will be able to communicate on the higher frequencies. On the *Lake Champlain*, there were instances where it was suggested to the operator that he avoid the interference being heard on 4 and 8 mc by calling on a much higher frequency. When this was done, Washington immediately replied.

Fading and Radiation Patterns

It will be seen from *Fig. 1* that a signal may reach the receiver by more than one instantaneous path through the ionosphere. Usually, it may come through by one ionosphere reflection and by two; or by two and three; and so on. These paths are of different and changing lengths, thus producing fading when the waves of one path cancel, or arrive out of phase of those of another path. Fading may reduce the strength of the signal by 1/10 or by 1/100, making stronger signal levels normally necessary.

In order to avoid having to increase the transmitter power to recover this loss, several methods of reducing the severity of fading have been devised. One of the best is to use separate receivers on separate antennas spaced several wavelengths apart. On shore stations, 1000 feet is a common spacing. On ships, where the total

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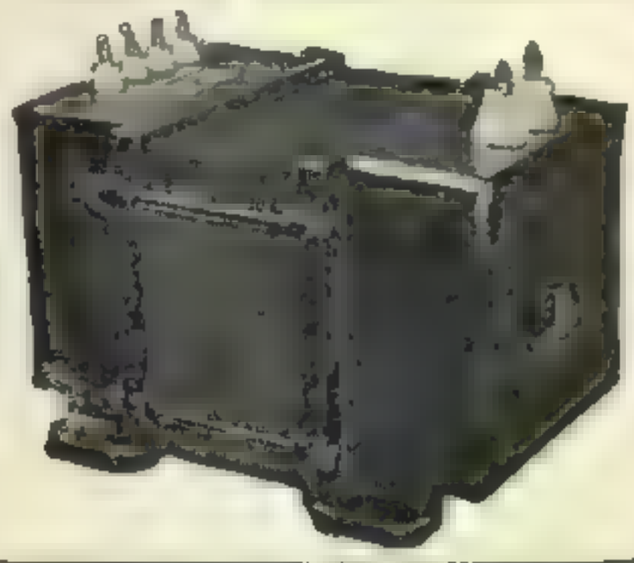

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available space is equivalent to an average amateur layout, a very noticeable improvement has been reported on 8 mc and higher during quick fading, with antenna only a few score feet apart.

The radiation pattern of any fixed station antenna is not equally effective in all directions. Interaction between nearby antennas occur, and pronounced shadows are found, making it very difficult to communicate in some directions. The difference may amount to as much as one-hundred times the power radiated in some directions, compared with others.

However, when considering long-distance communication via reflections from the ionosphere, it will be found that the desired signal may leave the antenna at high vertical angles. Proper placement of a vertical antenna is extremely important, since if the antenna is too long or the electrical height too great, the major radiation lobes will be wasted on ineffective angles. The British have made some tests in the jungle of Burma. They found that whip antennas used on portable equipment on high frequencies would only reach a little over a mile. This low range is probably due to the absorption by the dense foliage. But, using a low horizontal wire, sometimes only five feet off the ground, would permit communication for many miles, provided the frequency was low enough for ionospheric reflection.

Bell Telephone Laboratories demonstrated that to obtain the same results with a short whip antenna as with a horizontal wire, it would be necessary to increase the power of the sets several *hundred* times. At 75 miles, the same signal strength was received from a 3000 watt transmitter with a 15 foot whip, as from a one-watt transmitter and a horizontal wire antenna 7 feet high, or 1/6 watt into a sloping wire 5 to 30 feet high.

It is difficult to imagine 1/6 watt replacing 3000 watts, but it will be noted that short base loaded whip antennas have little or no radiation at near vertical angles. This explains the difficulties of the motor torpedo boats in the Leyte Gulf operation, which were unable to communicate with their operating area near Ormoc and their base in the Gulf. The motor torpedo boats were using vertical antennas, which are effective for about 20 miles and at very long ranges, but not at distances between perhaps 25 and 100 miles.

MATCHING STUBS

[*from page 24*]

wire size and spacing as for the line. Make the length something over a half-wavelength. Mount on stand-off insulators on a board or anything else convenient. Temporarily connect one end

to the transmitter and the other end to the line so that the Lecher wire becomes a part of the line. Then make your measurements on the Lecher wire.

The frequency (mid-point of the band) is, of course, known, and you now have (steps 1, 2, and 3, above) all the measurements required. The degree of mismatch is the same as the ratio of maximum to minimum current (or of minimum to maximum). Refer to *Table 2*. On the line for this ratio under *L* is the stub length for each frequency (see *L, Fig. 5*). To find the correct distance from the antenna to the stub (see *D, Fig. 5*), add the measurement (step *2*, above) to the distance *D* in Table 2.

For example: 144-148 mc band. Mid-point is 146 mc.

1. Short the line at the antenna.
2. Locate and mark minimum current point.
3. Remove the short.
4. Locate and mark new minimum current point.
5. Read meter—2 ma.
6. Measure distance between first and second minimum current points—6¾ inches.
7. Locate maximum current point and read meter—10 ma.
8. Determine ratio 10/2 = 5.
9. Refer to *Table 2*. Length of stub for ratio of 5 under *L* is 6 3/8 inches.
10. Point of connection is 6¾ inches (from measurement 6, above) plus 14 7/16 inches (from *Table 2*, ratio 5, under *D*) or 2 13/16 inches from antenna.

OSCILLOSCOPE

[*from page 22*]

net by a 1½" spacer at each corner of the plate The chassis is located in the cabinet 7/8" back from the front end to allow clearance for the various controls.

The cathode-ray tube socket, is mounted from the top of the cabinet by an angle bracket on each side of the socket. The keyway in the socket mounting plate is filed off so the socket can be rotated a small amount to align the tube. No steel shield was needed on the scope tube, since the magnetic fields of the transformers cancel out.

The filament, power transformer, and filter choke are mounted at the rear of the chassis. The filter choke (not shown) is directly behind the power transformer, fastened to the bottom of the cabinet. The mounting of the two transformers is left until the scope is completely wired and tested. Leads to the transformers are left long enough so that they could be moved around. The only adjustment necessary after testing the scope for operation is the 3-30 $\mu\mu$f trimmer condenser

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(*C4*) coupling the sweep voltage to the horizontal amplifier. This is set for the greatest coupling or capacity without distorting the sweep.

Magnetic Fields

To cancel out the magnetic fields of the transformers, the filament transformer is placed outside the cabinet, away from the cathode-ray tube. The power transformer is rotated through its planes to determine the point of minimum distortion in the horizontal and vertical sweeps and fastened in this position with angle brackets. The filament transformer is placed above the power transformer, rotated for minimum distortion, then fastened. The distortion can best be detected on the 15-60 cycle sweep speed, and when the transformers are properly located practically all ripple should cancel out.

Applications

Like any other suitably designed scope, many useful applications are found for this instrument. By applying one frequency to the vertical plates, and another frequency to the horizontal plates, harmonic relationships may be determined from the Lissajous figures formed on the screen.

A scope, of course, is an excellent high-impedance voltmeter, for either a.c. or d.c. when suitably calibrated. Calibration may be accomplished by connecting to any standard source and determining the deflection sensitivity of the system.

The scope affords one of the best methods of checking modulation percentage and linearity. To do this, couple the vertical plates to the r-f tank by means of a loop, and apply modulator output voltage to the horizontal plates from a potentiometer. Excite the speech channel from an audio oscillator, and a trapezoidal pattern will appear on the screen. At 100% modulation the trapezoid extends to a triangle with straight sides.

Distortion in the modulation system will cause the pattern to be clipped or curved. By using the internal sweep on the horizontal plates, the modulation waveform may be observed.

It is perhaps well to conclude with a note on elliptical (or double overlapping) modulation patterns. These are caused by a phase shift of voltage to either vertical or horizontal plates. To avoid this phase shift, always take the audio frequency from the output of the modulator, and make all leads to the plates short and "clean."

One of the handiest gadgets around the shack, this compact oscilloscope will handle just about any job that the ham can find for it. More thorough information on the application of the scope in amateur radio will appear in future issues.

CAMOUFLAGED SIGNALS

[*from page 18*]

described previously, with the exception that both time elements of a dot, dash or space on one channel are transmitted before switching to the other channel.

The Helleschreiber

Another type of printer which has been used extensively, particularly in Europe, is known as the Helleschreiber, after Dr. Helle who invented it. Such printers also use a form of equal-unit code in that each character is composed of twenty-nine equal units. Twenty-five of these are used in various sequences to actually print the character on a tape, and are arranged and scanned vertically from bottom to top of each successive row. There are five vertical rows each consisting of five pulses. The additional four units, to make the total twenty-nine, are always spaced and provide time for the scanning mechanism to move from one vertical row to the next. The relative position of the pulses as well as the manner in which the various characters are formed are shown in *Fig. 3*. When observed aurally, a Helleschreiber printer sounds like bursts of very high speed code in uniform succession with relatively long spacing between bursts. While this type of radioprinter has been used to some extent in this country, it has been largely replaced by the other systems which have been described because it is capable of a top speed of only about 45 wpm as compared to speeds of 62 wpm and up with the other system.

Radioprinters for the Ham?

The reader may ask what use he might make of radioprinter techniques in pursuing his hobby of amateur radio. Beyond identifying signals on the air at present it looks as though there would be very little need. But if one is given to daydreaming, many uses can be seen in the future. As an instance, designers and users of carrier-shift printer circuits have claimed reliable operation of such circuits with signal-to-noise ratios of *less* than one to one. What a boon that would be to an amateur on a crowded thoroughfare in a large city, with other amateurs using carrier-shift radiotelegraph circuits! He could make those signals which were buried in the noise background operate a tone keyer and enjoy solid contacts. Or with similar equipment on both ends of the circuit, the rabid DXer could work his DX and enjoy practically solid copy long before the signals were coming through strong enough for good aural copy and long after they had faded into the threshold of the receiver. These and many other possibilities present themselves to the experimentally minded amateur.

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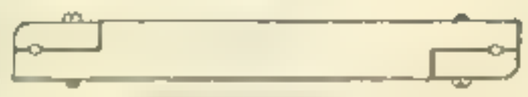

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50 WATT 6 band phone transmitter and Hallicrafters S-29 Receiver $150.00. Walter A. Bernath, W9RIY, 92 Elm Street, Maplewood, N. J.

IF TRANSFORMERS for 10.7 mc output on converters or AM/FM IF. Slug tuned from 6-13 mc. Zero coef. condensers. Heavy aluminum cans. Were for Airborne receivers (BC-624). Very good workmanship. $1 each. E. G. Taylor (W8NAF/9), Third and Ewing Sts., Seymour, Indiana.

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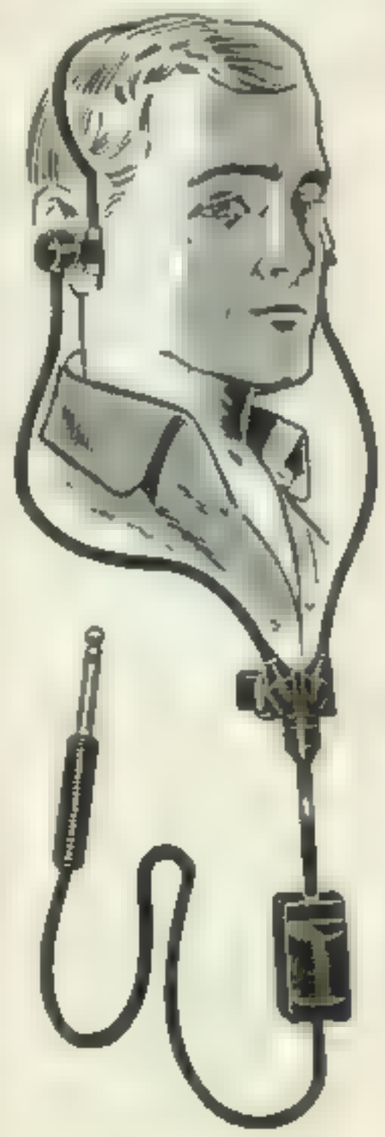
QSLs??? QSLs??? America's Finest!!! 10c for samples. "Lefty" Sakkers, W8DED, Holland, Mich.



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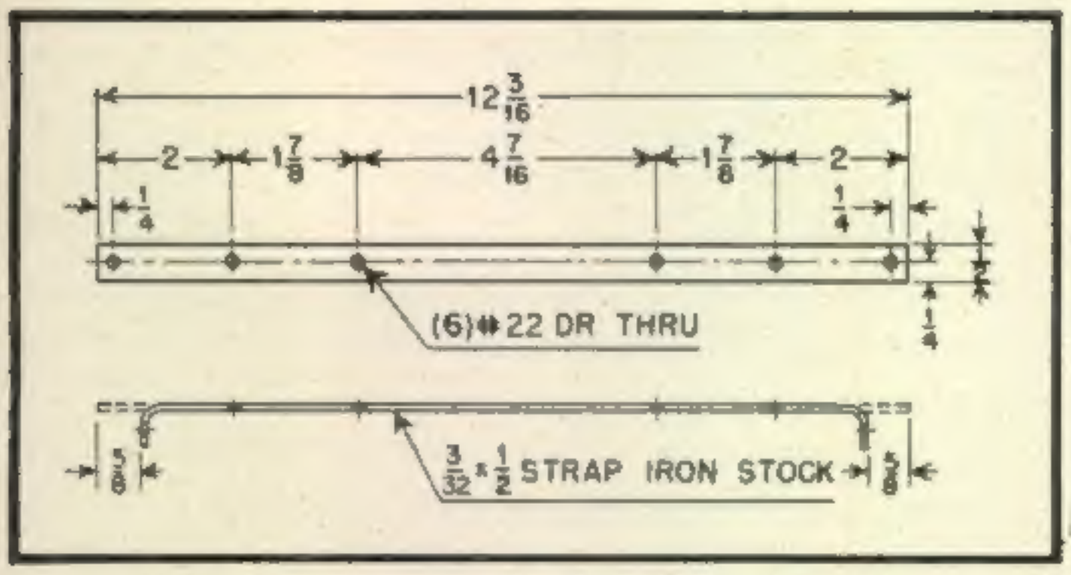
NOISE-PROOF

VACUUM CONDENSER

[*from page 14*]



Tube socket mounting bracket dimensions

one who can put on a nice crinkle finish to give the unit an appearance of not being homemade. Plenty of crinkle paint is now on the market with ample instructions for its application. Strap metal (3/16 inch by ½ inch) was used as brackets to submount the tube sockets to their proper depth below the chassis as well as lowering the plate terminals to the level of the plug-in coil strip and vacuum condenser. This strap metal stock was also used for the rear chassis supports. Flat-head machine screws were used for everything mounted on the panel and countersunk on the panel front. The countersunk screw head holes were filled with solder and sanded smooth before crinkle painting, thereby eliminating unsightly screw heads on the panel front.

Visual Indicator

The visual indicator is a simple mechanism which is driven from a small grommet on the ¼ inch tubing on the condenser end of the flexible coupling. It would be a bit easier to drive the indicator from the control knob shaft, but backlash would be transmitted to the indicator dial itself. It could be optional, however, as only a small amount of backlash exists. The idler pulleys can be most anything similar to that which is illustrated. For an indicator pulley we used a piece of tempered Presdwood (Masonite) and turned a groove down on the edge about twice the width of the dial cord. For an indicator pulley bushing an old bushing from a volume control was used. The shaft is threaded and screwed into a tapped mounting hole on the panel which provides a solid mounting. The indicator itself may be a piece of celluloid or heavy paper calibrated in any manner one chooses. The ratio between the grommet groove which is used as a drive pulley and the three-inch indicator pulley is about 8 to 1. As it takes six revolutions on the condenser drive shaft to run from minimum to maximum capacity, the indicator operates over about 300 circular degrees. Calibrations of zero to 100 cover these 300 degrees.

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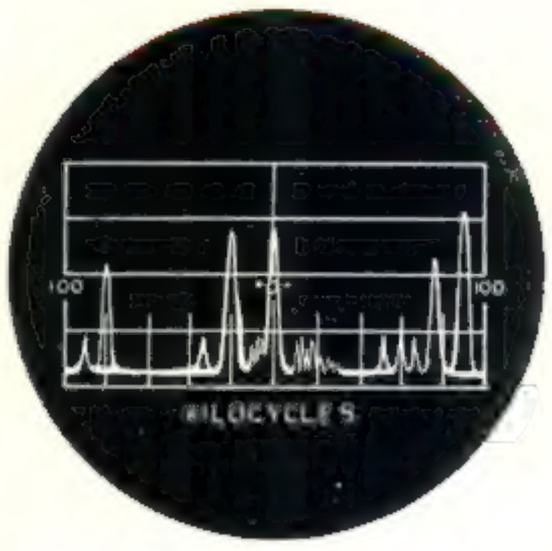
PANORAMIC RECEPTION

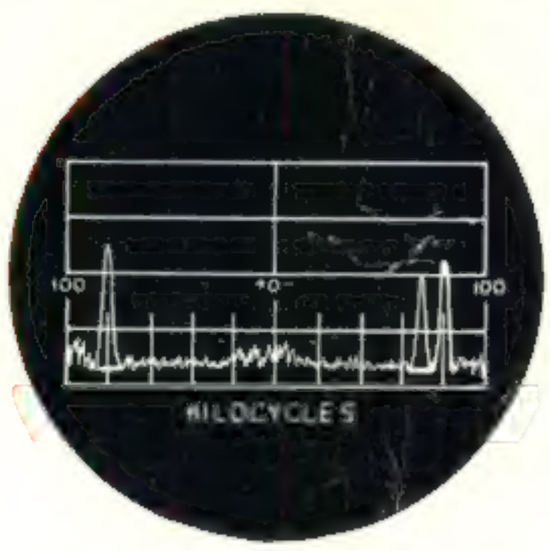
attends the opening of the 20 and 40 meter bands

When the 20 and 40 meter bands reopened for amateur communication with all the excitement and ceremony that usually accompanies a "first night," a Panadaptor sat in on the fun. Below is an account, with illustrations, of the activity that took place before, during and after that long-awaited ham occasion.

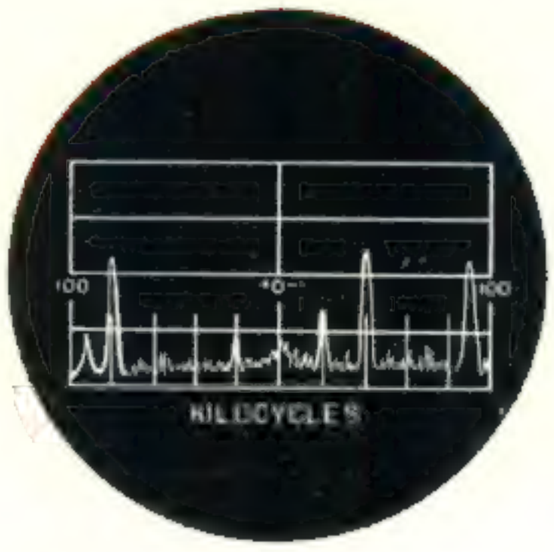
(As Viewed by W2LNP)



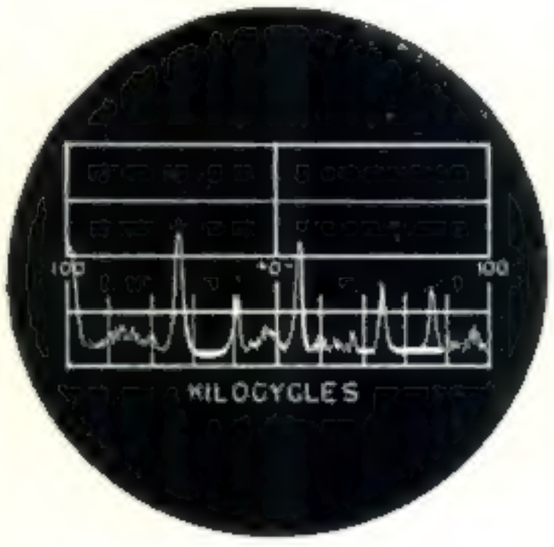
THE STAGE WAS SET! At approximately 1:30 P.M. the British Broadcasting Company and a Spanish station were still to be seen and heard on the 40 meter band. Their signals occupied the center of the screen. On the edge of the screen, but outside of the band, were a few cw and phone stations.



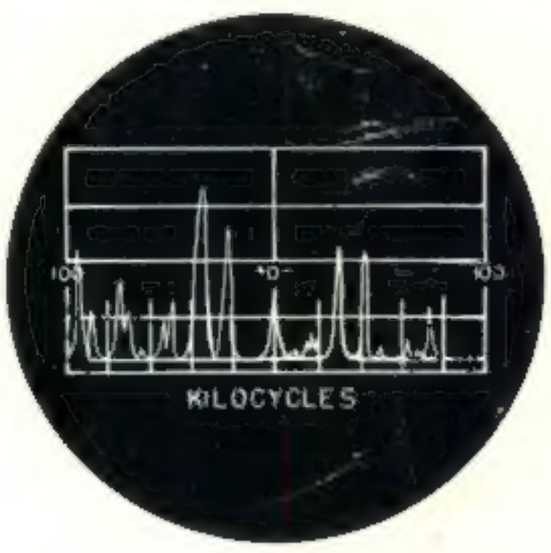
12 MIDNIGHT! All activity within the band ceased. The stations on the outside fringe remained on.



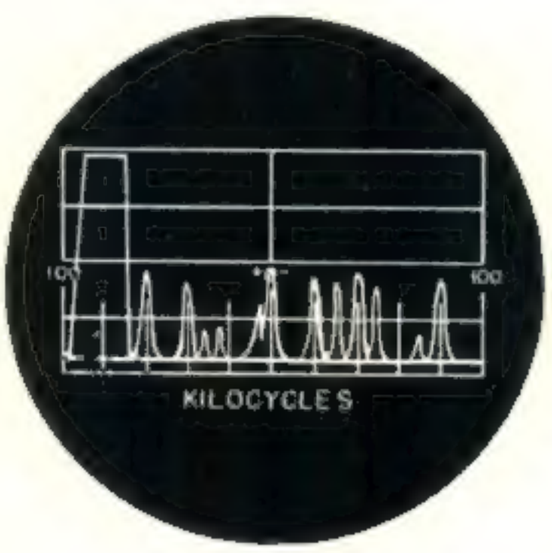
2:00-2:30 A.M.! Signals appeared on the band. Patterns of deflections showed that these were only carriers, and not actual communications.



A.M.! And the official message from the official station of ARRL, W1AW, announced to all amateurs that the 20 and 40 meter bands were again their property.



4:05-4:30 A.M.! Within a few minutes of the announcement, about fifteen stations were on the air . . . early birds! W2LNP, the station to which the Panadaptor was rigged, exchanged greetings with W6SET in Fontana, California, a station whose signal appeared on the screen.



4:45 A.M.! The number of stations on the air was growing. And activity on the 40 meter band appeared to be normal for the first time in many years.

About the same time, a large signal suddenly sprang up . . . which appeared to be a local station. This was found to some from KZ5AA in Panama, C.Z.

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